Heating and Ventilating

For Engineers and Contractors Controlling the Design, Specification, Installation and Maintenance of Heating, Ventilating and Air Conditioning

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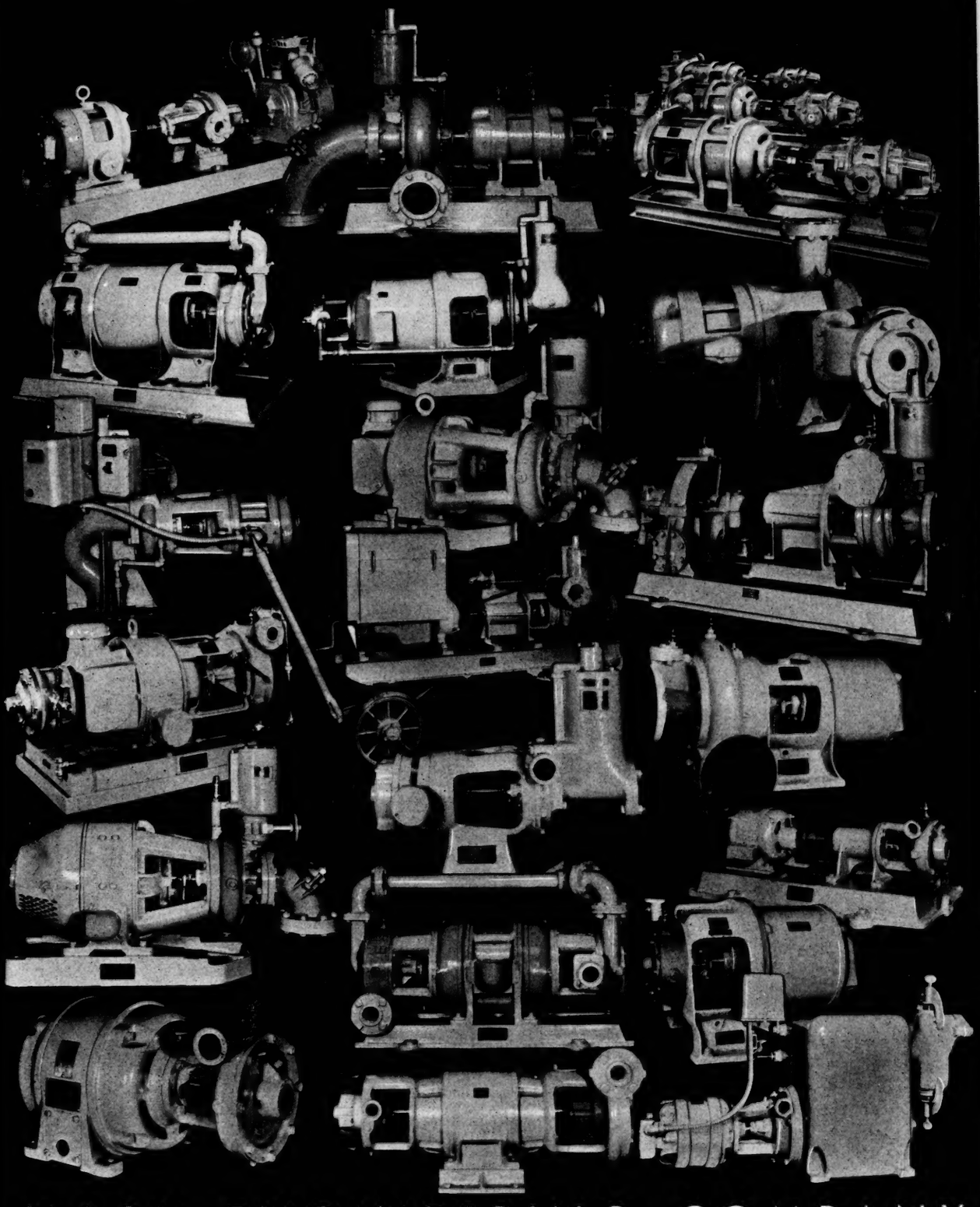

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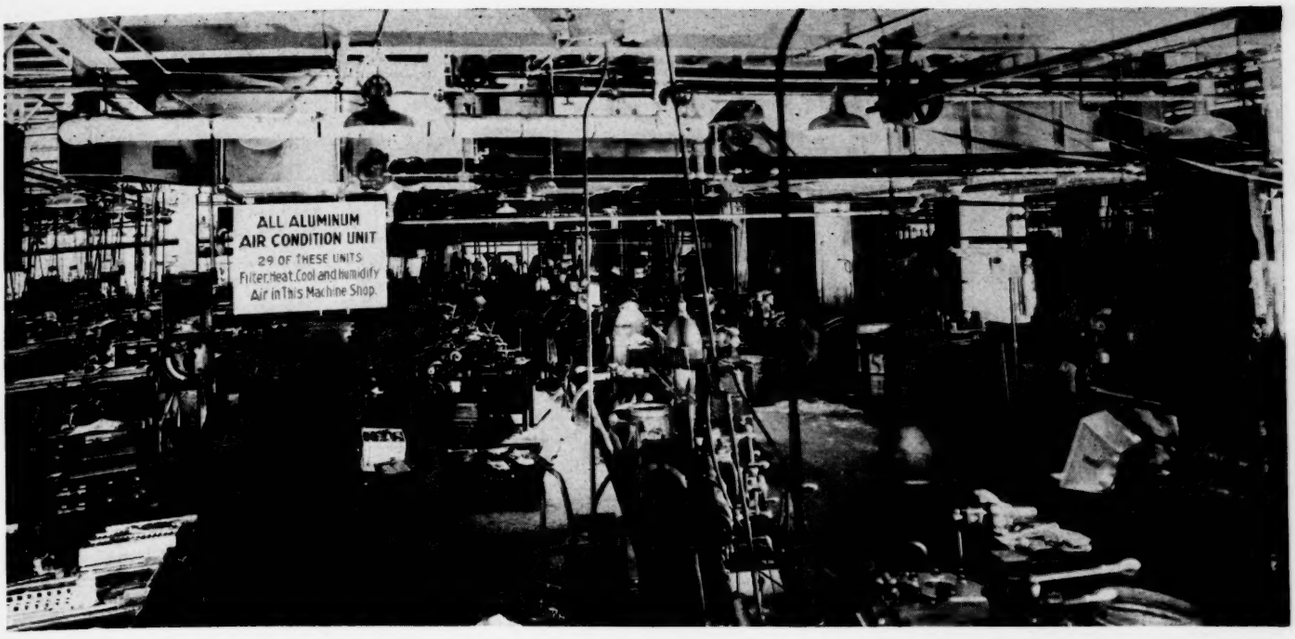


Machine shop of the International Business Machines Corporation plant at Endicott, N. Y.

Industrial Air Conditioning for Comfort

The International Business Machines Corporation plant is believed to be the first case of a large factory installing air conditioning for the comfort of the workers rather than for the furtherance of the process. The results in this plant are that colds among the employes have decreased 50%, the employes can work more comfortably, and the filters are removing nearly half a ton of iron and other dust from the air per year.

By J. M. DEMAREST†

THE International Business Machines Corporation has its main plant located at Endicott, N. Y., as well as plants located at Washington, Rochester, and a number of foreign countries. At these plants are made a complete line of tabulating machines for use in business, finance, and government for the correlation, tabulation, and printing of statistics of all kinds; complete supervised time systems; program and signal devices; time and job recorders, and a wide range of other machines and equipment for business and commercial use.

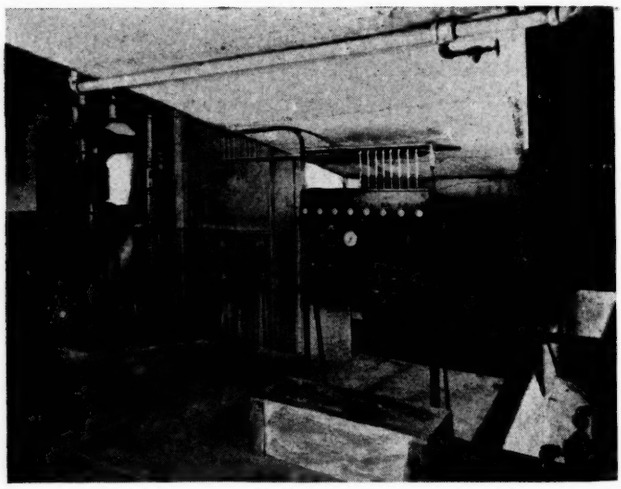
The plant at Endicott employs 3700 people, working in modern, fireproof, well-lighted, reinforced concrete buildings. The engineering laboratory, school, and boiler house are of brick and steel.

The main buildings are three stories in height and have a gross floor space of 591,406 sq. ft. and 8,280,000 cu. ft. total space. The net manufacturing area in these buildings is 525,000 sq. ft.

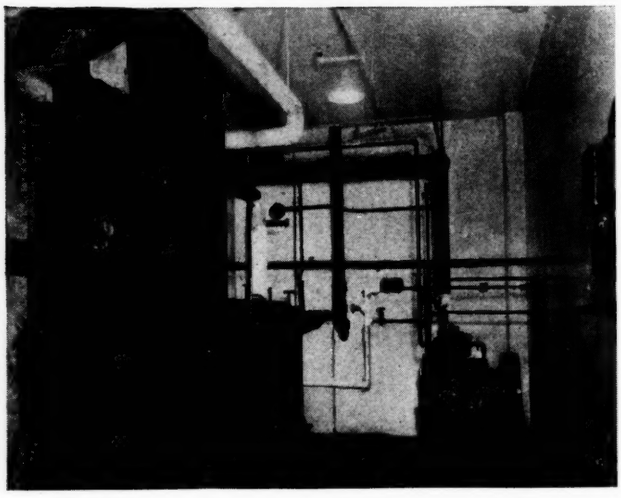
†Plant Engineer, International Business Machines Corp., Endicott, N. Y.

To indicate the vision and growth of this company during a time when many other industries were paralyzed during the period of depression, the total number of men employed at the Endicott plant in 1929 was 1899 and the total net manufacturing area was 330,000 sq. ft. The total number employed by this company throughout the world in 1929 was 5999 and in 1935 it is 8420. Thomas J. Watson, president of the International Business Machines Corporation, early in the period of receding business conditions, determined to increase the world wide sales force and the wisdom of this policy has been proven in the marked increase in sales which this company has enjoyed during the past four years.

In 1932 a new three-story engineering research laboratory was started at Endicott, N. Y., and the research engineering staffs from New York, Dayton, and other points were centered in the new laboratory. This building occupies a space 60 x 200 ft., and houses eight



The air conditioning unit with the master control board in the engineering laboratory building.



Accurate control of air conditions is necessary in the paper test laboratory. This view shows the air conditioning unit in this laboratory.

The Hall of Products where the company's tabulating and other business machines are displayed.

inventors' suites, including study, drafting room, and model assembly room. There are also many other office spaces assigned to special research men, a modern electrical research laboratory, chemical laboratory, metallurgical laboratory, paper test laboratory, and well-equipped machine shop for the building of model machines. In this building also is located the purchasing department and the hall of products where are displayed many of the machines manufactured by the company.

Early in the period of design and construction of the engineering laboratory, Mr. Watson, in accord with the trend of modernization of the Endicott plant, decided to provide air conditioning for comfort throughout this new building to provide cool air in the summer time at a constant relative humidity best suited for comfort, and heated air in the winter time with moisture added to the air to provide the best humidity conditions for comfort, consistent with outside temperature conditions and their effect on condensation on the windows.

With the success of air conditioning in the new engineering laboratory, Mr. Watson determined to provide air conditioning in the main machine shop of the factory, covering the ground floor of six buildings, with a total net manufacturing area of 79,700 sq. ft. This section of the manufacturing plant, due to the high heat loads from machines and occupants, had been difficult to ventilate to a sufficient degree to provide comfort to the workmen. It had also been found that the number of colds contracted in the machine shop and treated in the medical department was in far greater proportion to the number of men employed than in the rest of the factory.

The total number of men employed in the conditioned area of machine shop group is 652 on the day shift and 302 on the night shift.

The manufacturing units located in the air conditioned area are the drill press, milling machine, hand screw machine, automatic screw machine, grinding, gear cutting, maintenance, straightening and bench work, tool making, and special machine departments. Here, due to the rapid growth of the sales of the company and the development of new products, the machine shop has become burdened and congested with work.

In the laboratory there are two air conditioning systems; one for the cooling of the building and the other for the conditioning of the paper test laboratory, where accurate tests are made under varying temperatures and humidity conditions of all paper stock used in the printing of tabulating cards, time cards, bank checks, and special forms printed in the printing department.

The main air conditioning system in the laboratory building is designed, under summer conditions, to reduce the temperature to 10° below the outside dry bulb temperature, with a minimum temperature of 75°, with a relative humidity of 40%. The winter conditions in the engineering laboratory are the maintaining of a temperature of 72°, with a relative humidity varying from 20 to 40%, depending upon the outside temperatures, with the relative humidity kept low enough with the low outside temperatures to prevent an excess

of condensation on windows. In the paper test laboratory the temperature may be varied from 40° to 100° and relative humidities from 100% to 15% may be obtained, so that tests over any length of time deemed necessary may be run with maintained conditions. The conditions of design set down for the machine shop are essentially the same as those in the laboratory, with the exception that slightly lower relative humidities are required in the winter time, due to the large amount of roof and skylight glass in the one-story sections located between three of the three-story wings.

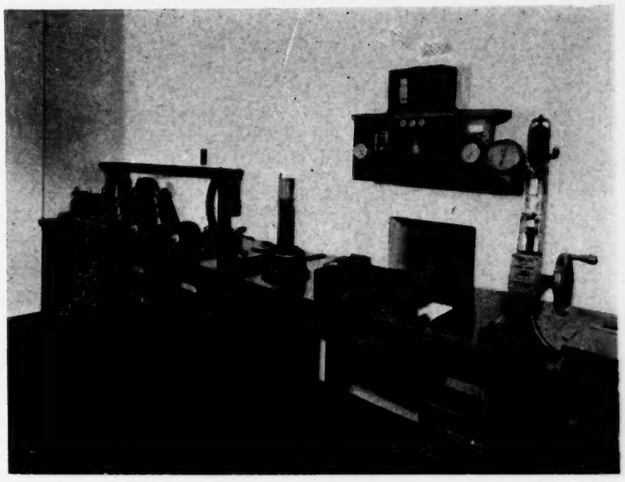
In the main air conditioning system in the engineering laboratory the conditioned air is distributed by a central fan through ducts to all parts of the building, with return of the recirculated air through the corridors and through a return air duct to the fan room. Approximately 20% of the total air delivered is outside air. This is mixed with returned air in the fan room where it passes through a bank of filters of the cloth type. The air then passes over the cooling coils, then through the humidifying chamber, and then over the secondary heater section to the fan. Approximately 20% of the heat is added in the secondary coils during winter conditioning. The outside air is tempered on entering the fan room by tempering coils, which are thermostatically controlled to maintain a constant inlet temperature under winter conditions. All cooling, humidifying, and dehumidifying is done in the fan room. However, approximately 80% of the heating takes place at the air inlets to the rooms by means of booster heaters, which are automatically controlled through air-operated valves actuated by individual room thermostats. Each room has a sub-master control panel at which the control is changed from winter to summer or summer to winter conditions. In the summer the cooling to the rooms is maintained by air-actuated dampers, which regulate the quantity and thereby the temperature of the room.

The main control panel is located in the basement at the fan, where humidity and cooling water circulation through the cooling coils is controlled. In the winter conditioning period water is pumped through spray nozzles, with the amount controlled by a master humidistat located in the return air zone.

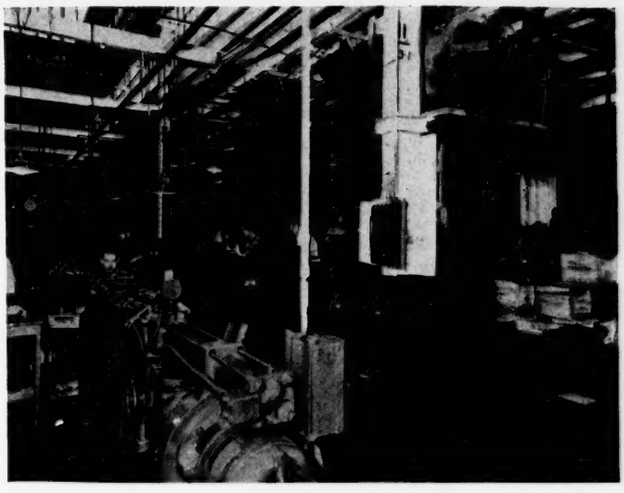
All coils, casings, and parts in contact with moisture are made of aluminum to prevent corrosion. The cooling medium in the cooling coils is chilled water supplied by a circulating pump and is cooled by a 60-ton ammonia refrigeration unit automatically controlled to supply cooling water at 38° to the cooling coils.

The cooling system for the paper test laboratory employs an ammonia refrigeration machine which cools a brine tank from which the brine is circulated through the cooling chamber. The amount of brine circulated is controlled by means of air-operated valves actuated by thermostats.

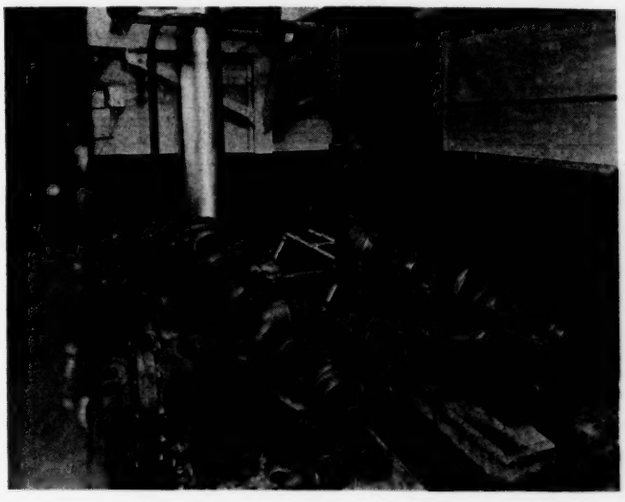
In the factory machine shop smaller individual units were used, each completely controlled for the particular area supplied by the individual units. A total of 29 units are used, of which six are fresh air units supplying outside air to the conditioned area, and 23 are recirculating units.



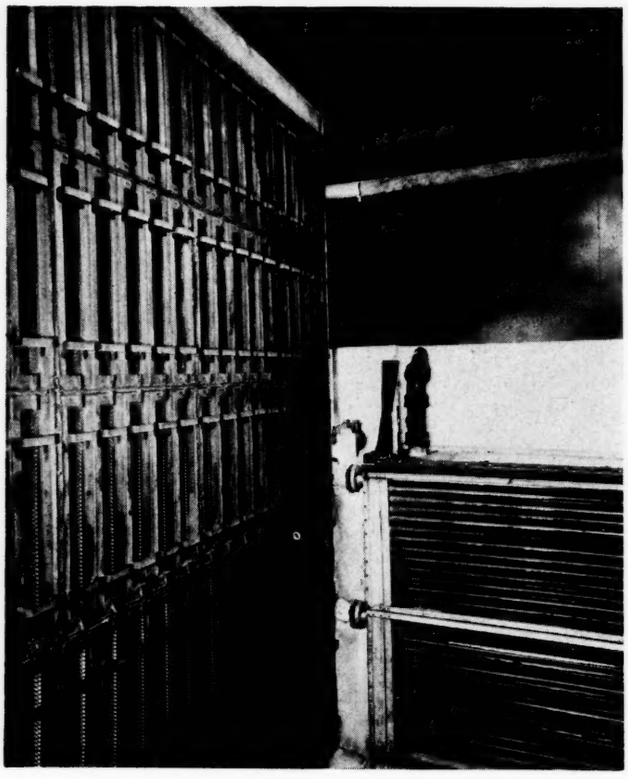
The control panel for the air conditioning system in the paper test laboratory.



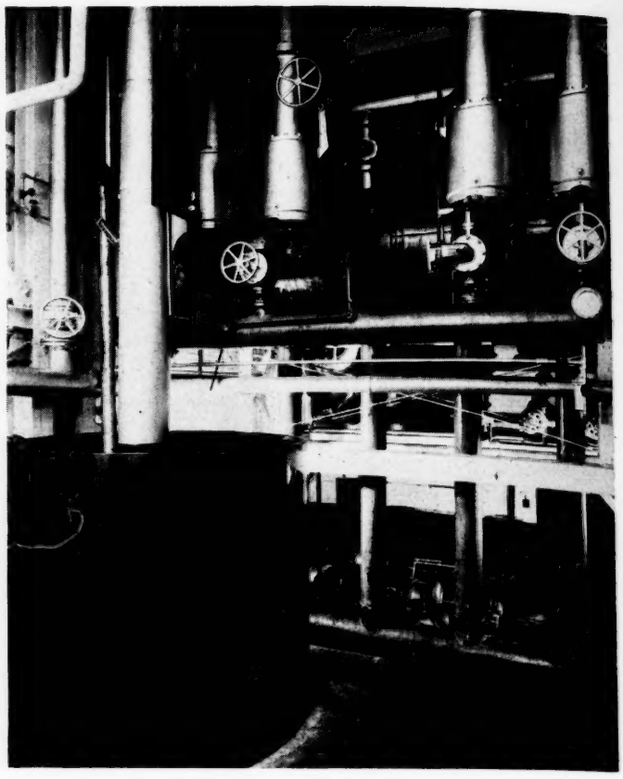
The control panel for the air conditioning plant in the machine shop.



The pumps for circulating the chilled water in the machine shop.



A view of the filter units in the engineering laboratories



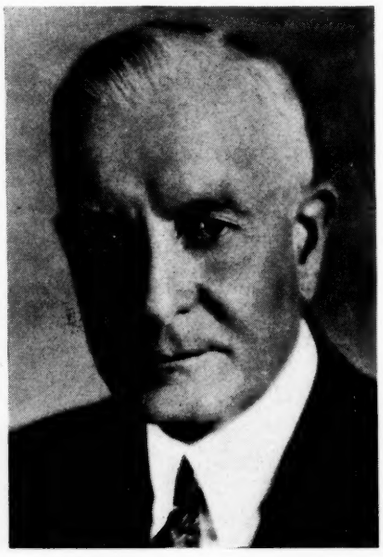
The steam jet refrigeration equipment for the machine shop.

Each recirculating unit consists of a bank of steel wool filters located at the inlet end of the unit, a bank of cooling coils, heating coils, fan, and outlet diffusing grilles. Each outside air unit has a tempering coil on the inlet from outdoors. The air then passes through filters, water sprays, cooling coils, heating coils, fan, and diffusing grilles.

Humidity is controlled by means of humidistats which actuate air-operated valves to control the quantity of water to the spray nozzles. Each unit has a master control panel by which the control is changed from winter to summer control conditions or from summer to winter.

One of the problems in control of humidity was to regulate the relative humidity with the outside temperature. This is accomplished by means of a master thermostat which controls the air pressure to the spray control valves. This master thermostat is so adjusted that at 40° the thermostat gradually changes the air pressure in the control line so that the relative humidity is decreased to 15% at 10° outside temperature.

One of the main reasons for using small units is to eliminate the necessity for air ducts due to the lack of space available, and the interference they would cause to line shafting, pulleys, conduit, hoists, etc. All units are of the cooling coil type. All surfaces in contact with moisture, including coils and casings, are of aluminum. Two of the recirculating units are arranged so that they can be changed to outside air units in the winter time by changing a damper.



Thomas J. Watson, president of International Business Machines Corporation, who decided to condition his company's plant to provide greater comfort for the workmen.

In selecting the type of refrigeration for the machine shop, it was decided to use a vacuum refrigeration system, since exhaust steam was available in large quantities in the summer time, as exhaust from the engines driving the direct current generators in the engine room. In the winter time all of the exhaust steam is required for heating, while in the summer time much of it was being wasted to atmosphere.

In the design of the air conditioning system, 500 tons of refrigeration effect were required to cool the machine shop 10° with an outside temperature of 85° or more. The question of design then was to determine whether well water could be found in sufficient quantities or whether it would be more economical to recirculate the water through the units and provide 500 tons of refrigeration with condenser cooling water supplied either from a cooling tower or pumped directly from wells.

It was found that an ample supply of water was available from deep wells and that the most economical means of cooling was to pump the well water, which could be had at 51°, through a refrigeration unit of

250 tons capacity, then pumping this water through the units. The returns from the units are piped to a barometric condenser with piping provision for part of the return water from the units at 56° being used for factory drinking water.

At the present time the returns from the barometric condenser are wasted to the sewer. However, this water at 75° provides a potential source of cooling water for future air conditioning condensers or for the condensing of exhaust from the engines.

The barometric condenser is of the two-stage type, with inter-condenser and the exhaust from the jet on the inter-condenser carried to waste. Six thousand, seven hundred and fifty pounds of exhaust steam per hour is supplied to the steam jets, creating the vacuum on the flash tank. Three hundred pounds of steam at 100-lb. pressure is supplied to the steam jet exhausting air from the barometric condenser and 100 lb. per hr. of steam at 100-lb. pressure is supplied to the steam jet on the inter-condenser.

J. M. Demarest, plant engineer of International Business Machines Corporation, Endicott, N. Y., in charge of the air conditioning system.

The well water is pumped from deep wells located approximately three-quarters of a mile from the plant, through a 12-in. cast-iron water main, supplying 1200 g.p.m. to the flash tank. The wells are drilled to a depth of 165 ft. and obtain their supply from an underground stream located in a sand and gravel bed about 40 ft. deep at this level.

The static water level in the wells stands about 27 ft. below ground level and the draw-down of the wells when pumping 1,200 g.p.m. is from 15 to 18 ft. The water is pumped by means of vertical turbine-type pumps, with vertical hollow shaft motors. The pumps are equipped with 50-hp. motors, operating with 220 volt, 3 phase, 60 cycle current, and are controlled by means of pressure switches, providing automatic stopping and starting of the pumps, to insure a supply of water at all times.

The refrigeration room is so located that the power house attendants operate the refrigeration system without additional help, and in the operation of the flash tank, which is divided into four compartments, three of the steam and water valves are hand operated supplying three of the compartments, with the fourth compartment controlled by automatic valves, actuated by thermostatic control, to hold the temperature of the water supplied to the units constant.

The filter units are cleaned on an average of every two weeks in the machine shop and every two months in the laboratory.

Based on the time that the units have been in operation in the machine shop, the estimated total amount of dirt taken from the recirculating units equals 935 lb. per year. Of this amount of dirt taken from the filters, 71% is iron dust from the machines and 19% is oil; the remainder is lint, cotton, soot, and wood dust. From the fresh air units there is approximately 100 lb. of dirt removed per year. Formerly, this dirt was in the air in circulation and, therefore, being breathed by the occupants of the machine shop.

It was found after this system was placed in operation that the number of treatments for colds in the machine shop decreased 50%.

The design and installation of the air conditioning systems have been installed under the supervision of the plant engineering department of the International Business Machines Corporation.

Clean Air Electrically

DEVELOPMENT of an electrical unit to remove dust, soot, pollen, or other solid and liquid particles in air has progressed to the point where engineers of the Westinghouse Electric & Manufacturing Company now have several experimental models installed in homes and offices of the Pittsburgh district.

Data are also being gathered by physicians who are using the units in their treatment of patients afflicted with any of the numerous types of asthma or pollen fevers.

No completely satisfactory system for removing particles from air had been completely developed until electrical engineers found the answer. Their solution came in the form of an electrostatic air cleaner, which permits the particles to remove themselves from the air.

Electrically the unit is a comparatively simple device. It is so arranged that it draws particle-filled air past two small wires, suspended horizontally. Connected to a power pack, which raises their voltage, these wires "charge" all air particles in their vicinity. This act is termed ionizing the air. Next the ionized particles are drawn through a series of plates which are also charged. The plates have opposite polarity, with the result that just as a needle jumps over to a magnet, so do these air particles move and cling to the plate. Thus the air is made to clean itself.

In addition, a film of oil covers each plate to make certain that the particles will stick after being attracted. After the aluminum plates fill up, they may be cleaned by simply running water over them.

The air, freed of particles, is then sent on into the room by means of a fan. The unit only requires about 50 watts to operate, the same amount of current consumed by an ordinary electric lamp.

In certain sections of Pittsburgh, 97% of the impurities collected was in the form of soot. In outlying sections, the larger percentage of particles consisted of various irritating pollens.

Protecting Air Conditioning and Ventilating Systems Against Fire Hazards

By E. W. FOWLER†

A COMPLETE air conditioning system is sometimes referred to as an all-year system in contrast to summer air conditioning units and winter air conditioning units. The functions performed by the summer unit are cooling, dehumidification, air circulation, and air cleaning; those of the winter unit are heating, humidification, air circulation, and air cleaning. The winter units are sometimes operated in summer as ordinary ventilating systems. Systems which only cool the air, and other incomplete systems, are sometimes incorrectly referred to as air conditioning systems.

The engineer laying out an air conditioning system is confronted with so many problems relating to cost of installation and operation, construction difficulties, and so on, that he may fail to remember that his design should be made so as to discourage the spread of fire. This phase of design and installation is capably discussed by the author in this abstract from his paper presented before the National Fire Protection Association's annual convention in Atlanta in May

A central-station air conditioning system may be employed to condition the air in a large building of many separate rooms or floors, necessitating extensive ductwork, or a number of systems may be used. Where it is desirable to maintain different air conditions in different sections, this can be more easily done with separate systems. Also, with separate systems operation can be limited to those sections where it is needed. From the standpoint of fire hazard there is an advantage in the smaller separate systems, in that ductwork can be kept localized and passing of ducts through fire walls can be avoided. The greater the extent of the duct system the greater the potential hazard of spreading fire through the building.

Features involving possible fire hazards which should be considered, in addition to those which will be touched upon later under Ducts and Fans, are the following:

(1) Heating elements should be installed in a standard manner, with due regard to proper clearances between hot surfaces and woodwork and other combustible materials. Heat insulating materials should be incombustible.

(2) Coils carrying refrigerants which are flammable or which, on the basis of toxicity, are listed in Classification Groups 1 to 4 inclusive, in Underwriters' Laboratories' Report on the "Comparative Life, Fire and Explosion Hazards of Common Refrigerants," should not be placed in the conditioning unit or anywhere in the duct system. Common refrigerants which are flammable or which are within the above range of toxicity are: ammonia, butane, dichlorethylene, ethane, ethyl bromide, ethyl chloride, methyl bromide, methyl chloride, methyl formate, propane, and sulphur dioxide. Refrigerating equipment should be installed in a standard manner.

(3) Air filters of readily flammable materials should not be used.

(4) Oil used in air filters of the viscous type should have a high flash-point—not less than 300° F., and preferably higher.

With proper attention to the above features, the fire hazard of an air conditioning system is similar to that of a mechanical ventilating system, modified somewhat by the presence of a water spray, if used. The probability of fire starting in or being started by the equipment itself is small.

Air Ducts. — The fire hazard of ventilating systems lies principally in the ducts through which smoke and hot gases can quickly spread from one room to another. Because fires in ducts are difficult to fight, large fire losses may be expected where they are made of, or are lined with combustible material, are of metal in contact with wood floors or partitions, or are not properly provided with fire dampers and other necessary protective devices.

The fire hazard of ventilating systems in large buildings can be greatly reduced by dividing the systems into several small units to reduce the building area which a single duct system can involve. In this way openings in fire walls can be avoided and the number of necessary fire dampers can be reduced.

There are several ways in which air ducts may assist in spreading fire. Fire may originate in combustible material (or in another building) located close to the fresh air intake, and burning gases and hot smoke be discharged into and ignite combustible material in various parts of the building; burning gases may enter a ventilating opening in one room and be carried through the duct into other rooms; the duct may get sufficiently hot from the hot gases passing through it to ignite woodwork or other combustible material in contact with or not properly separated from it, and there is also the possibility of a duct being ruptured by an ex-

†Engineer, National Board of Fire Underwriters.

plosion or by falling debris permitting fire to enter the duct and come out at discharge outlets in other rooms.

Aided by the forced draft of a mechanical ventilating system, the spread of fire may be very rapid and extend throughout a large building in a short time. With a recirculating system there is the added possibility of hot burning gases from a fire in one room being drawn back to the fan and being discharged through the building. In the burning of wood, paper, and other carbonaceous materials—except in the open where there is plenty of air—considerable quantities of the flammable and poisonous gas, carbon monoxide, are given off; because of this and the possibility of other dangerous fumes being present, discharging the products of combustion through a building may be a matter of life hazard as well as fire hazard.

Possibilities for spread of fire are inherent in the duct system so that safeguards are necessary for ducts of ventilating and cooling systems as well as for warm-air ducts. A warm-air duct would seem to present a greater fire hazard than a cold-air duct, but if the duct is safeguarded in its installation against the possibilities of igniting combustible material in the event of burning gases passing through it, it will obviously be adequately safeguarded for its usual role of conveying warm air for room heating.

Ducts which carry flammable vapors, dusts, or flyings present all the possibilities for contributing to the spread of fire that other ducts do, and also present an additional source of fire hazard in the burning of the materials in the ducts. Sufficient air is usually intimately mixed with the substances in the ducts to form favorable conditions for combustion or explosion. Combustion once started may proceed mildly, depending on the proportion of flammable material to air, but is more apt to result in an explosion the violence of which will be influenced by the additional factors of size and length of duct.

By giving proper attention to construction, installation, and protection of the ducts, the possibility of their serving as ready means for the spread of fire can be greatly reduced. Suggestions covering these features are given in the Regulations for the Installation of Blower and Exhaust Systems. The ducts of air conditioning systems in dwellings should be installed in accordance with the requirements for the ducts of gravity warm-air heating systems as contained in the Recommended Building Code of the National Board of Fire Underwriters (Fifth Edition, Section 1208). One additional feature to be remembered in connection with dwelling installations is that air should never be drawn from any basement or furnace room, not occupied as living quarters.

The fundamental principle which should be borne in mind is that the ducts should be so constructed, installed, and protected as not to materially reduce the effective fire retardant value of walls, floors, or partitions the integrity of which must be maintained from reasonable protection against the rapid spread of fire from one portion to another.

In two recent instances serious losses resulted from the use of readily combustible linings in ducts for purposes of sound deadening. These two fires are mentioned in the report of the Committee on Blower Systems. They have demonstrated that combustible linings in air ducts constitute a serious hazard.

Fans.—In case of fire fans blowing air into sections of buildings (other than basements) where the fire is, or to which it may spread, should be shut down. Because large quantities of air are needed to burn most combustible materials, continuing to blow air into the area where the fire is would assist the combustion and have the effect of adding fuel to the fire. For this reason it is important to have means for shutting down fans, which would be accessible in case of fire, or to have them arranged to shut down automatically when fire or hot gases reach them. This latter arrangement is strongly recommended. Where the movement of air from the ventilating or air conditioning system would interfere with the operation of automatic sprinklers, fans should be arranged to automatically shut down before the sprinklers operate.

It is sometimes desirable to operate certain types of exhaust systems during a fire to carry away smoke and fumes in order to permit fire-fighting operations to be more effectively pursued. It should be noted, however, that exhaust systems always draw in an amount of air corresponding to the amount of smoke and gases exhausted.

In exhaust systems where ducts become coated with flammable deposits, such as exhaust ducts from kitchen ranges, which frequently become heavily coated with grease and dust, the fan should be arranged to stop automatically in case of fire in the duct, as the coating will ordinarily burn with intense heat even without the aid of the fan.

Few Arkansas Rural Homes Have Central Heat

OUT of 20,365 homes surveyed in rural Arkansas only 33, or 0.16%, had furnace heat, according to a survey made by Prof. Deane G. Carter of the University of Arkansas, College of Agriculture. Of these 33 installations, 30 were in the homes of white owners.

In the survey an effort was made by questioning each house occupant to determine the desire for house improvement. The question was worded "Were the following specified amounts available for improving your home, what would you spend them for?—$500, $250, and $100?" Three hundred and thirty-three, or 0.26%, including duplications, specified that they would favor using the money for a central heating system of some kind.

District Heating Utilities Cut Costs,

rehabilitated and replaced equipment last year while new construction was quiet

INVESTMENT paralysis, so general among utility companies during recent months, was reflected in the small amount of new construction of district heating facilities. Activities were confined largely to increased attention to utilization work among present customers, to improved operating methods, and to a search for new customers. However, there was a limited amount of new construction and a notable interest in replacement and rehabilitation. Institutional construction and replacement of central heating while not reaching the extent of other periods, was reasonably active and one such plant of highly unconventional design appeared. Institutions too showed the effects of the times by an increased interest in keeping operating expenses down.

Technical Developments

Technical improvements which came in for prominent consideration nearly all had to do with attempts to cut operating costs, principally costs to the user of the steam. Among these were new methods and equipment for control. Experience among district heating companies and others generating steam at a central plant has so conclusively shown the importance of controls which will closely follow the demand that these control devices are now the prime implements for putting customer utilization work into effect. Concentrated drives for business on the part of competitive methods of steam supply made customer utilization work of especial importance to a growing number of steam utility companies. In some cases only by giving a maximum of attention to supplying customers with the least amount of steam was it possible to keep loads up to the amounts of previous years. Control based on changes in outside temperature is now an accepted method where district steam is used. Methods were made available which took more notice than ever before of all the factors which govern the heating demand. So also was increased consideration given to means of limiting the supply in order that excessive demands might be avoided.

Of technical interest, too, was the matter of the use of steam ejector refrigeration, principally for air conditioning purposes. Several more such equipments were connected to district steam lines while a number of others were installed in buildings having their own steam generating plant. While interest continued, collection of operating figures is slow, and no factual material of especial note was made public in connection with the operation of such plants.

Plant and Equipment

Changes in plant or equipment, as well as events and future plans are always of interest and worthy of note. The following summary is the result of a survey among utility companies offering a heating service in the principal cities.

Detroit—Reports that business held up well in the face of competition from oil and coal, and that a construction program is planned to start during 1935 and to extend over a 10-year period. The program contemplates replacement of the oldest underground mains, some of which date back to 1903.

Iowa — Among the several properties of the Iowa Electric Light and Power Company, that at Perry, Ia., was the scene of the rebuilding of a considerable portion of the hot water mains. Approximately 40% more heating load was also connected. This year it is expected that more of the old mains will be reconstructed. At Boone, Ia., an extensive new business campaign is planned as well as a major reconstruction of the older mains. At Marion, Ia., new business was secured and a small amount of reconstruction is planned. At Cedar Rapids an active campaign for new business was continued on account of natural gas being brought into town.

Milwaukee—Additional distribution capacity for future expansion was provided by the replacement of a section of the steam distribution serving customers in the east side of the Milwaukee River. The section replaced was installed in 1907 in a tunnel passing under the river. A 26-in. line took the place of two 16-in. cast-iron mains. In the course of reconstruction it was necessary to find a suitable method of securing anchorages without piercing the tunnel wall. This was done by means of inserting concrete rings keyed to the existing tunnel walls. The close working quarters and poor condition of the old tunnel made working conditions difficult. At the same time that the 26-in. main was installed, a 4-in. high-pressure line and a 4-in. return were also placed in the tunnel.

Philadelphia—During the year a total of approximately 4500 lin. ft. of distribution and service lines were added to the system and the number of customers increased by about 25%.

Pittsburgh—Although fuel prices increased recently, operating practices and economies continued to improve. Very little change was made in plant and distribution facilities, except the installation of some additional long distance recording instruments for the use of the system operator. The new Post Office and the Federal Building, which have been under construction for several years, used steam for the first time in considerable quantities during the past heating season. Two newspaper publishing plants are using small quantities of jet steam for humidification, this being a new application as far as service from the utility company is concerned.

(Concluded on page 82)

Cooperative Central Heating Plant Completes 17 Years of Service

All of the above buildings, except the one at the extreme left, are heated by the cooperative plant.

A small district heating system supplies eight buildings in New Britain, Conn., with steam at a cost of 95.2 cents per thousand pounds of steam

FOR approximately eighteen years a group of privately-owned buildings in New Britain, Conn., has obtained steam for heating and industrial work from a cooperatively-operated central plant. A study of the very complete records which have been kept reveals that, barring minor fluctuations, the steam cost is decreasing yearly and is now less than $1 per 1000 lb. of condensate. The average cost over the 17 years has been $1.232 per thousand pounds. A comparison with the former method of heating with individual plants reveals that the total cost of heating is now less than the previous cost of coal. To this must be added the convenience, decrease in fire risk, elimination of dust, and increase of space.

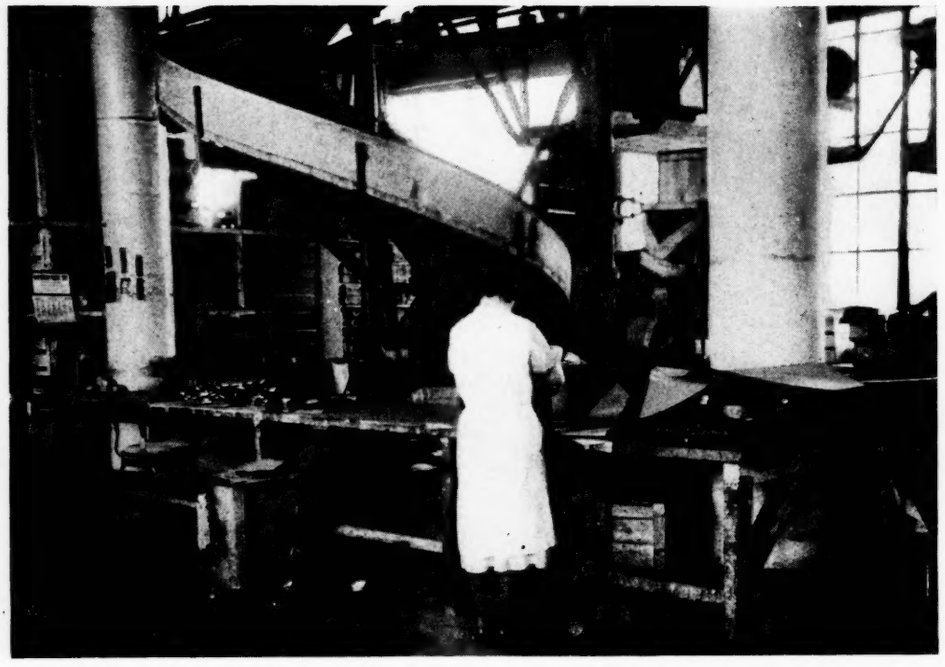
The beginnings of this cooperative plant go back to 1917. At that time the Beaton & Cadwell Mfg. Company, prominent maker of plumbing and heating supplies, decided to erect a modern fireproof building to house its manufacturing facilities. To reduce heating costs, this company gathered together the owners of nearby buildings and proposed the construction of a cooperatively-owned and operated plant to heat all the buildings. The plant was to be supervised by the Beaton & Cadwell Mfg. Company and was to sell steam to the buildings at cost. A detailed statement of the expenses was to be submitted to each owner at the end of each heating season.

The owners of nine buildings agreed, and a plant was erected in a one-story extension to the then new Beaton & Cadwell building.

At the present time a total of eight buildings are being heated, six business buildings containing retail stores, offices and lofts, and two factory buildings. Heights of the structures vary from three to six stories. The majority of the business buildings and one factory are of brick, the other of concrete. The largest structure in the group, a modern six-story concrete building, is occupied by Beaton & Cadwell. At the rear is a one-story extension which contains the steam generating plant for the group.

Description of the Plant

In this small addition are two boilers. One a 150-hp. tubular boiler and the other a smaller vertical type. The larger boiler supplies steam during the heating season and the small vertical one is used only in cases of emergency and during the summer to furnish steam for industrial use. Both boilers are hand fired and



Shipping room in the six-story concrete building of the Beaton & Cadwell Mfg. Company.

burn bituminous coal. Steam is supplied to the heating system at about 1½-lb. pressure during normal heating weather and at about 3-lb. pressure in very cold weather.

All the condensation from the various units in the group are returned to condensate receivers by two single-cylinder steam pumps. Condensation meters measure the amount of condensate from each system. Another steam pump forces the condensation from the receivers into the boiler.

The heating surface in the Beaton & Cadwell plant is mostly of the pipe coil type, except in the offices on the 6th floor where tubular radiators are employed. Approximately 6000 sq. ft. of surface are provided in this building. This company also requires steam to heat the water in its plating tanks. During the summer the steam for these tanks is generated by the small vertical boiler.

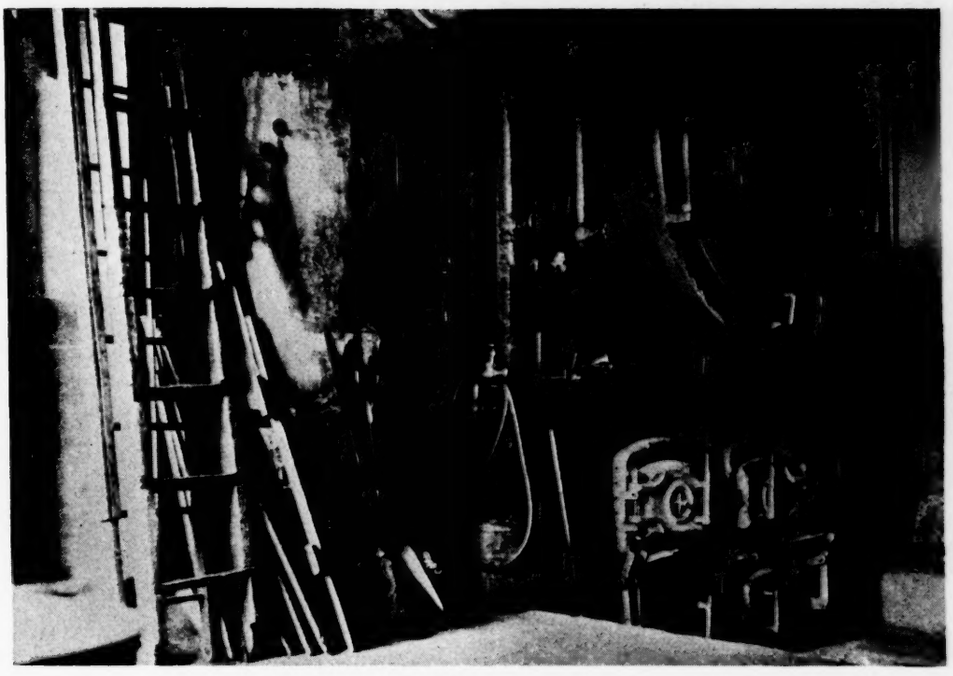
Direct steam radiators are installed in the other buildings of the group, and each building owner is responsible for the system in his own building. No attempt is made by the operating men in the boiler room to supervise the heating systems in the individual buildings. This results in a considerable difference in the amount of steam used per square foot of surface.

Figures on the steam consumption for the past 18 years are shown in Table 1.

Distribution of Costs

At the end of each heating season a report is made

Boiler room which contains equipment for heating the eight buildings.



Interior of boiler room. Small vertical boiler at left is used for emergency and for supplying industrial steam during the summer. Right is the 150-hp. tubular boiler.

to the individual building owners of the amount of condensate returned by his building, and of the total cost of producing the steam. Included also on this cost sheet is a detailed listing of the items making up the cost. These include fuel and cartage, wages, general supervision and clerical work, boiler insurance, coal space rent, depreciation and interest. The general supervision and clerical charge was not made until after the depreciation and interest item was eliminated. A summation of these items gives the gross cost of operating the plant.

Deducted from this gross cost is a credit item which is made up of the value of the coal on hand at the end of each heating season, and also of the value of the coal used by Beaton & Cadwell for supplying steam to its plating tanks. Since there is no meter on the return line from the plating tanks this firm is charged directly for the amount of coal used. The credit item is then deducted from the gross cost, giving the net cost for heating for that season. Dividing the net cost by the total condensate metered for the season gives the cost per thousand pounds.

In order to have money on hand to meet expenses, each building is charged at the beginning of the season with an amount based on one half the previous season's consumption. Monthly bills are rendered at the rate of $1 per thousand pounds of condensate consumed during that month, less a credit of one half. Then when the next yearly report is issued the building is credited if it has been overcharged, or billed for the additional amount if undercharged. At the present time the preseason charge is equal to one half of $1 per thousand pounds of condensate used during the previous season. For the past five years the cost per thousand pounds has averaged approximately 95 cents per thousand pounds.

The plant was built in 1917 at a total cost of $16,819.90. At that time it was decided to charge the plant off in 10 years or to have a depreciation of 10% per year. Interest was to be paid on the remainder at the rate of 6%. As a result, by 1926 the entire plant was paid for, ending the fixed charges. After this the cost of steam was made up of actual operating expenses only. The cost of steam in the 1926-27 season was $1.477, while in 1927-28 it dropped to $1.0951 per thousand pounds of condensate.

Cost Comparisons

Actual records of heating costs for individual buildings previous to the operation of the central plant are not available, although there are some figures on the

TABLE 1. STEAM USED BY THE NINE BUILDINGS FOR EACH HEATING SEASON
(In Thousands of Pounds)

Building No.	1933-34	32-33	31-32	30-31	29-30	28-29	27-28	26-27	25-26	24-25	23-24	22-23	21-22	20-21	19-20	18-19	17-18
1	1079	1351	1390	1668	1464	1519	1247	1381	1179	1351	1949	1915	1736	1556	2163	1685	1385
2	816	613	471	672	792	642	630	644	709	948	900	1048	976	653	1023	796	817
3	1933	1296	1534	1668	1664	2083	1924	1354	1782	1607	....	....	....	....	....	1451	1465
4	1557	1232	1539	1332	1331	1430	1329	1218	1139	1170	997	1083	1027	654	878	836	1094
5	745	749	770	738	850	749	729	626	635	549	450	559	534	428	555	456	403
6	653	674	764	880	774	800	667	612	826	541	517	667	534	384	630	502	....
7	1637	1625	1704	1899	1847	2053	1277	1456	1046	1171	1514	2030	2136	1620	2113	2310	2887
8	507	522	384	554	473	676	522	564	710	865	760	602	507	550	588	409	518
9	....	....	....	....	....	180	289	106	....	....	....	....	203	246	339	168	243

TABLE 2. COST DATA FOR COOPERATIVE STEAM PLANT, NEW BRITAIN, CONN.

Heating Season	1933-34	32-33	31-32	30-31	29-30	28-29	27-28	26-27	25-26	24-25	23-24	22-23	21-22	20-21	19-20	18-19	17-18
Fuel and cartage ...	$5294.24	$4658.83	$5386.25	$5641.67	$6318.20	$6596.29	$7039.84	$7778.29	$6977.61	$5947.98	$9053.59	$13639.69	$9614.20	$12333.13	$8442.15	$7455.09	$8279.59
Repairs and supplies ...	891.29	1233.20	558.14	919.66	448.99	744.49	508.09	1267.89	845.34	1312.55	799.22	407.93	369.46	554.80	912.78	639.12	22.88
Wages	2001.38	1303.40	1693.72	2072.16	2101.02	2128.39	2001.62	2217.28	2186.33	1848.73	1810.45	1680.80	1283.61	1521.48	2243 14	1542.87	1151.62
Supervision .	500.00	500.00	500.00	500.00	500.00	500.00	500.00	—	—	—	—	—	—	—	—	—	—
Insurance	—	57.10	—	—	101.66	—	—	—	—	—	54.43	—	—	88.50	—	—	—
Coal space rent	—	—	—	—	—	—	—	—	50.00	300.00	300.00	180.00	380.00	347.50	180.00	120.00	87.67
Depreciation @ 10% ...	—	—	—	—	—	—	—	1681.98	1681.99	1682.00	1681.99	1682.00	1681.99	1682.00	1681.99	1682.00	1681.99
Interest @ 6%	—	—	—	—	—	—	—	100.92	201.84	302.76	403.68	504.60	605.52	706.44	807.36	908.28	1009.19
Gross Cost ..	8687.10	7752.53	8138.61	9133.49	9469.87	9969.17	10049.55	13046.36	11943.11	11394.02	14103.36	18095.02	13934.78	18133.85	14267.42	12347.36	12332.96
Credit (see text)	187.76	176.32	289.28	329.00	431.88	413.41	616.35	1287.44	946.63	1200.76	3107.10	6297.00	2376.94	8184.22	3162.65	1972.61	—
Net Cost	$8500.34	$7576.21	$7849.33	$8804.49	$9037.99	$9555.76	$9433.20	$11758.92	$10996.48	$10068.26	$10996.26	$11798.02	$11557.84	$9949.63	$11104.71	$10374.75	$12232.96
Total condensate, 1000 lb	8927	8062	8556	9411	9177	10132	8614	7961	8026	8202	7087	7906	7654	6091	8349	8611	8878
Cost per 1000 lb.	$0 9522	$0.9397	$0.9174	$0.9355	$0.9848	$0.9431	$1.0951	$1.4770	$1.3701	$1.2275	$1.5516	$1.4923	$1.5101	$1.6336	$1.3301	$1.2049	$1.3800

Plot plan of buildings heated by the cooperative plant.

amount of coal used. Building 8 required an average of 46 tons of anthracite, and Building 2 about 60 tons. The average price at that time for delivered anthracite was about $15.50 per ton. During the first years of operation Building 8 used approximately 550 thousand pounds of condensate at an average cost of $1.50 per thousand, or a total cost of $825 as compared with a cost for coal alone under the old method of $713.

The cost for heating Building 2 during the first years was about $1350 per season. The coal cost alone would have been approximately $930.

As is to be expected, the cost of heating these buildings has decreased considerably since the plant has been paid for. The cost for heating Building 8 during the past four or five years was $475 in comparison with a cost of $695 during the first years of operation of the plant. Building 2 during the past five years has cost approximately $665 per season to heat, in comparison with a cost of $1350.

Instrument panel in pump room of the plant.

Air Conditioning for Reserve Board Building

and erection of a new fabricated house features of developments in Washington. Quarter billion allotted for housing

WASHINGTON—Specifications for the new four-story and basement white marble building to be erected here on Constitution Avenue, N.W., by the government for the use of the Federal Reserve Board will call for the installation of an air conditioning system. Paul P. Cret of Philadelphia has been selected as the architect.

The contract for installing an air conditioning system in the private dining room, room no. 16, and bedrooms no. 28 and 29 in the Executive Mansion at Washington, has been awarded to the Washington Refrigeration Co., 1731—14th St., N.W., Washington, D. C. The contract figure was $2,460. Work is to be carried on under the supervision of the National Park Service, Department of the Interior.

Bids have been advertised for covering the installation of a warm-air heating system in the U. S. Pecan Experimental Station at Meridian, Miss. The opening date for bids was May 28. This project is under the supervision of the purchase and sales division of the Department of Agriculture.

The following concerns are prospective bidders on the project for the installation of an air conditioning system in the Navy Building, 18th St. and Constitution Ave., Washington. Bryant Air Conditioning Corp., Star Building; G. A. May, 1519 L St., N.W.; Columbia Specialty Co., 1636 Connecticut Ave.; M. G. Phillips, 1108—16th St.; Reid Hayden, Inc., 1103 Vermont Ave., N.W.; The Trane Co., 726 Jackson Place; Harwood-Nebel Construction Co., 2539 Pennsylvania Ave.; Westinghouse Electric Manufacturing Co., 1703 L St., N.W.; Zephyr Air Conditioning Oil Heating Engineers, Inc., 1722 H St., N.W., all of Washington, D. C., and also Riggs Distler Co., 236 N. Calvert St. Baltimore, Md.; Hampshire and Decker, 330 West 24th St., Baltimore, and Keasby and Mattison, Ambler, Pa.

This project calls for air conditioning rooms 2625, annex, and rooms 2627, 2629, 2631, 2633, 2635, and air conditioning and insulating rooms 3421-3436, all in the Navy Building. The National Park Service, Department of the Interior, is in charge of the project.

The Reliance Refrigerating Machine Co., 3401 North Kedzie, Chicago, was the low bidder on the job of installing air conditioning in the Post Office and Court House, at New Orleans, La. The bid price was $15,945. The next higher bidder was the Carrier Engineering Corp., Washington, D. C., with a bid of $17,340. This job is in charge of the procurement division, public works branch, Treasury Department.

A new type of modern house made its debut here May 6. The skeleton of the house is of steel frames which can be completely erected in two days or less. Prefabricated materials are utilized throughout the house. Four weeks after the first bolt is tightened, the house will be finished and ready for occupancy.

The houses, developed by the Berger Manufacturing Company of Canton, a subsidiary of Republic Steel Corporation, being erected here will be priced at $6950. This includes not only the house itself, but the lot, landscaping, sewer and water connections, sidewalks, drives — in fact the complete property.

Warmed or cooled air, depending on the season, is circulated in ducts built into the steel frames. Vitiated air is withdrawn into inconspicuous, attractive grilles and carried through the walls, floors, and ceilings of the house.

One of the ingenious features of the house is a plumbing stack or chase, a self-contained, box-like unit containing all water pipes, vents and flues which serves both the kitchen and bath and becomes an actual part of the wall. All kitchen equipment is placed along one wall. A gas heating and air conditioning unit is at one end, followed by a gas range, laundry tub, sink, and mechanical refrigerator all of which are of table height and can be used as a continuous working surface.

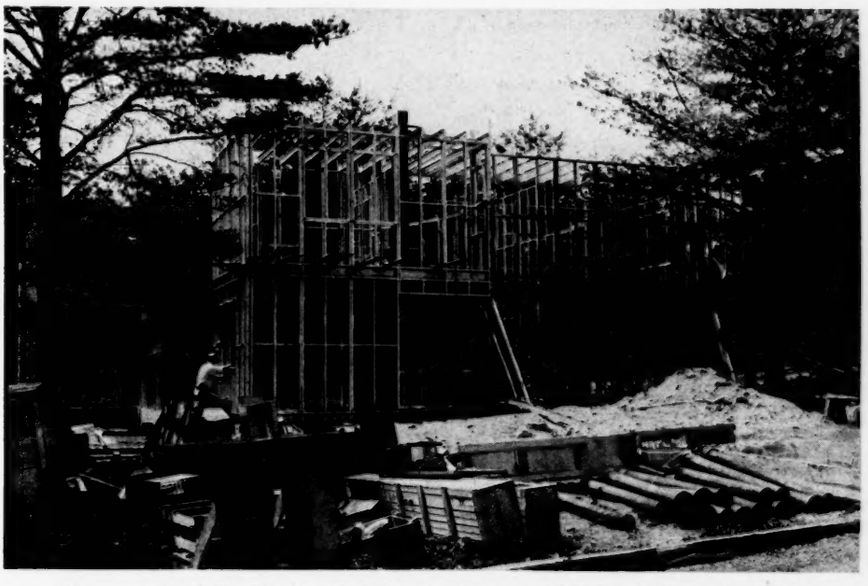
The houses are modern in design and appearance and are the creation of Kastner and Stonorov, technical consultants for the Berger Manufacturing Company. They recently designed a 280 apartment development in Philadelphia, the first limited dividend corporation housing project completed under PWA.

The steel wall frame units for the houses are rectangles, 3 ft. wide and of desired ceiling height. Steel window and door frames are shop welded into rectangles of the same size, making all frames interchangeable. The frames are bolted to the foundation and to each other, and steel floor and roof joists bolted to the rectangular wall frames, making a complete, rigid, steel skeleton for the entire house. The entire house is encased in a 1-in. sheathing of cork before the exterior finish is applied.

Roofs of the Washington houses are flat and basements have been eliminated. The houses can be built with a basement and any type of roof. The exterior will be white painted brick with stucco front entry and porch. Room arrangement eliminates all waste space and reduces housekeeping to a minimum.

Recommendation of allotment of $249,860,000 to PWA, housing division, for the development of 67 s'um clearance and low-rent housing projects was made May 16 by The Advisory Committee on Allotments.

Thirty-six of the projects were among those affected by the impoundment of $110 million of PWA housing division funds, and action of the committee today reinstated their original allotments. Thirty-one of the projects were new applications which had been examined by the housing division and placed on file.



Framework of the Berloy steel frame house erected by five men in 15 hr.

$160 Million for Heating and Ventilating Equipment

is indicated under tentative plans for spending the $4 billion Work-Relief money. Material will be purchased by Treasury Procurement Division

FEVERISH activity has characterized the efforts of President Roosevelt and his assistants in starting the four billion dollars of the federal work-relief program on their way to unemployed citizens.

How the Program Will Work

Already the work-relief program is open for business. Projects will be filed through existing or new federal agencies, as well as by state or local organizations provided for that purpose.

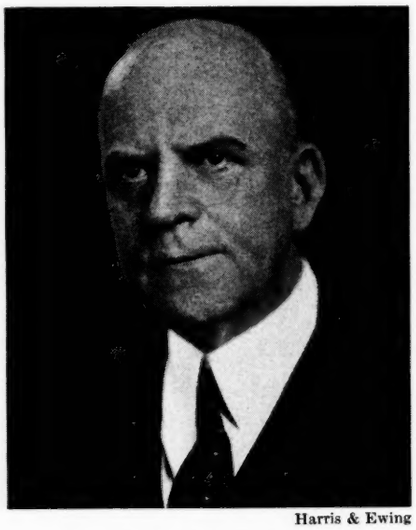
All projects thus developed will then go to the newly-organized division of information and application, presided over by Frank C. Walker, head of the National Emergency Council. This division will determine if engineering or other study is necessary, and assign such tasks to the regular government departments best qualified to handle them. Estimates of cost will be checked, length of time necessary for completion will be passed upon, percentage of direct labor will be certified, and the economic justification will be determined.

Acme

Frank C. Walker, head of the National Emergency Council and head of the newly-organized Division of Information and Application.

Each project thus reported on will be passed to another new alphabet agency, WAB, or Works Allotment Board, whose chairman is Secretary Ickes. This Board will decide whether it believes money should be allotted to the project. Projects will be allotted by districts, not by states or other political subdivisions. Recommendations for allotments then will go to President Roosevelt, who will either approve, reject, or change them. When the President has approved an allotment, the money and the plans will go to the agency that is to do the work.

Copies of plans also will go to Harry L. Hopkins, who now heads another new agency, the Works Progress Division. It will be the job of WPD to see that supplies are bought, that persons on relief rolls are hired, and that work is done within the required time.



Harris & Ewing

Rear Admiral Christian J. Peoples who in addition to being Paymaster General of the Navy is Chief of the Treasury Department Procurement Division and a member of the Federal Emergency Administration of Public Works.

Briefly, Mr. Walker will have charge of planning, the Ickes board, with the approval of the President, will have charge of financing, and Mr. Hopkins will be the works superintendent. Hopkins will also remain as head of the Federal Emergency Relief Administration, and Ickes[1] will have supervision over PWA work already begun, and of the urban housing division, in addition to his relief work job.

Mr. Walker has divided all applications into four classes: federal projects, non-federal projects, work-relief projects, and administrative expense projects.

Federal and non-federal projects already pending before PWA need not be resubmitted, but will go direct to the applications division. They then will be returned to the originating governmental departments for review in connection with work-relief objectives before being transferred by Walker to the Allotment Board.

New federal projects will be filed directly with Walker by the various government agencies, be reviewed and submitted simultaneously to the Works Progress Division so Hopkins can pass on the potential employment. Thereafter it passes from the Applications Division to the Allotment Board.

New non-federal projects will be submitted to state PWA directors by individuals, states, counties, cities, or other governmental agencies. PWA will prepare the actual applications and again Walker will transmit copies to Hopkins for a check on the work potentialities.

In addition, work-relief projects will be initiated by the Progress Division in localities "where the relief situation is such as to demand small useful projects to provide a maximum of direct employment." Such projects will include those recommended either to state relief

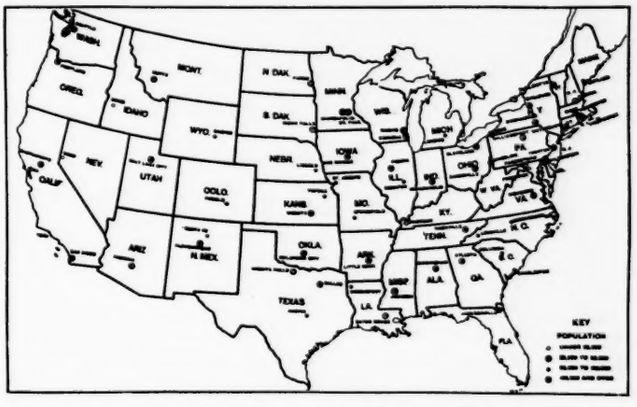
(Concluded on page 82)

[1]Col. H. B. Hackett, PWA housing director, has been made assistant (to Ickes) PWA administrator. Angelo Clas succeeds Colonel Hackett as housing director.

16.3% of Urban Homes Need Major Repairs

and 61.8% of town and city residential structures are over 15 years old. Real Property Inventory indirectly reveals huge market for heating modernizing

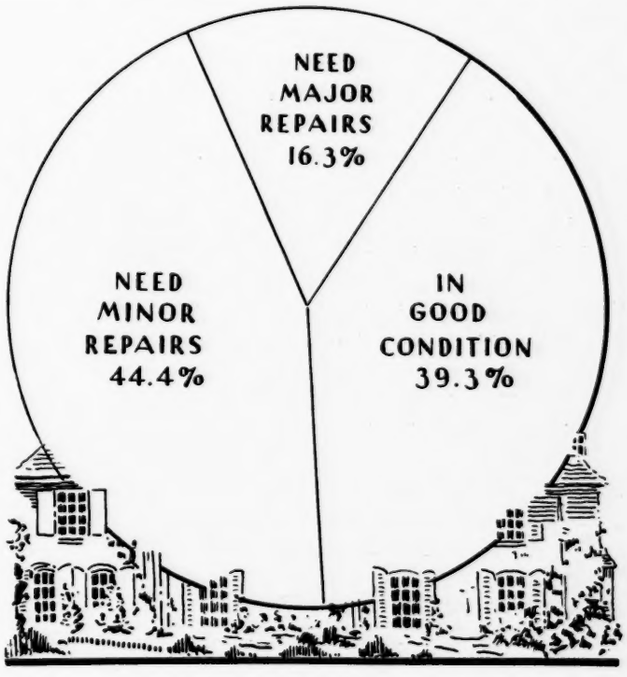
OF the 14,249,179 urban residential structures 2,315,003, or 16.3%, are in need of major repairs, and 6,329,344, or 44.4%, are in need of minor repairs. These figures are shown by an analysis of the recent Real Property Inventory made by the government and projected to cover all of the urban residential structures. The survey of urban residences made by the Real Property Inventory covered about 14% of the total urban homes in the country.



Location of cities surveyed under the Real Property Inventory.

The east south central territory, comprising Kentucky, Tennessee, Alabama, and Mississippi, showed the highest percentage of structures needing major repairs, since 27.9% of all the urban residential structures in that territory were either in need of major repairs or unfit for use. The south Atlantic section running from Delaware to Florida had 23.1% of its homes in this condition. New England had the smallest percentage of homes in bad shape—only 10.5% falling in this classification. Conversely, the east south central group had the smallest percentage of structures in good condition, followed by the south Atlantic states. However, the middle Atlantic states had the highest percentage in good condition with 44.9% in this classification and New England with 43.9% in good condition. The number of structures needing minor repairs was almost constant throughout the country and ranged from 41.7% in the Rocky Mountain states to 48.6% in the east south central.

How many of these homes which need modernizing need improvements in their heating systems is difficult to estimate but it seems reasonable to suppose that practically all of the homes needing major repairs plus a considerable number from the classification needing minor repairs would need modernizing. This is borne out by an examination of the figures covering the age of the structures. A large proportion of the homes over 15 years of age would probably need modernizing in one form or another. The accompanying table shows that 61.8% of the urban residential structures in the country are over 15 years of age. Consequently, somewhere between the 16.3% in need of major repairs and the 61.8% structures over 15 years of age we might expect to find a percentage which need modernizing. If this were taken as the average of the two it would mean that 39%, or approximately 5½ million homes are in need of some kind of heating modernizing.



The condition of urban houses in the United States, as indicated by the Real Property Inventory.

As might be expected, the greatest proportion of old structures in the coun-

TABLE 1. POTENTIAL MARKET FOR MODERNIZATION OF URBAN RESIDENTIAL STRUCTURES
(Projected from data of Real Property Inventory)

Region	Total No.	In Good Condition		Need Minor Repairs		Need Major Repairs	
		No.	%	No.	%	No.	%
New England	986,246	433,948	43.9	453,673	45.6	98,625	10.5
Middle Atlantic	3,848,058	1,727,778	44.9	1,700,842	44.2	419,438	10.9
E. North Central	3,427,534	1,302,463	38.0	1,549,245	45.2	575,826	16.8
W. North Central	1,262,768	503,844	39.9	540,465	42.8	218,459	17.3
South Atlantic	1,139,624	366,959	32.2	509,412	44.7	263,253	23.1
E. South Central	646,206	152,858	23.5	314,056	48.6	179,292	27.9
W. South Central	1,054,152	393,199	37.3	451,177	42.8	209,776	19.9
Mountain	347,124	128,783	37.1	144,751	41.7	73,590	21.2
Pacific	1,537,467	595,000	38.7	665,723	43.3	276,744	18.0
Total	14,249,179	5,604,832	39.3	6,329,344	44.4	2,315,003	16.3

try are found in New England, where 72.1% of the homes are old. In the middle Atlantic 66.3% of the houses are over 15 years old, whereas in the west south central states, comprising Arkansas, Louisiana, Oklahoma, and Texas, only 45.1% of the homes are over 15 years old. In these states 54.9% of the homes are under 15 years old, whereas in the Pacific states 49.5% are under 15 years old.

Some interesting calculations can be made of the potential market for modernizing from the accompanying tables and the fact that the loans made under the insurance plan of the FHA have averaged $417 per loan. Of these loans, 5.4% are for heating and the average size of the heating loan is about $250.

TABLE 2. AGE OF URBAN RESIDENTIAL STRUCTURES
(Projected from data of the Real Property Inventory)

Region	Under 15 Yr. Old		Over 15 Yr. Old	
	No. of Structures	%	No. of Structures	%
New England	275,163	27.9	711,083	72.1
Middle Atlantic	1,296,796	33.7	2,551,262	66.3
E. North Central	1,275,043	37.2	2,152,491	62.8
W. North Central	448,283	35.5	814,485	64.5
South Atlantic	400,008	35.1	739,616	64.9
E. South Central	279,161	43.2	367,045	56.8
W. South Central	578,729	54.9	475,423	45.1
Mountain	124,270	35.8	222,854	64.2
Pacific	761,046	49.5	776,421	50.5
Total	5,438,499	38.2	8,810,680	61.8

Department Store Air Conditioning System

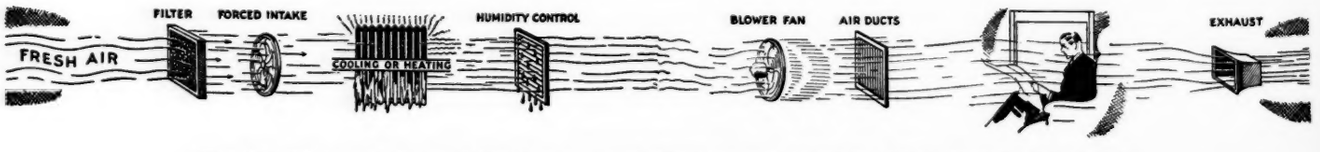
THE William Filene and Sons Department Store in Boston is said to be the first department store in the world to install air conditioning throughout, according to Alfred C. Buensod, who described the installation at a recent meeting of the Air Conditioning Bureau of Boston. In 1926 this store first installed air conditioning in the basement and found it profitable.

The store occupies a whole city block, eight stories high. A partition separates the old from the new building. Selling is carried on on all floors, excepting the top two.

Among the problems faced by the air conditioning engineers was one of expansion. The old part of the store may be replaced at a later date and the system must be such that it can be tied in. The ducts were located under and over the balconies and so built that the outlets have moveable vanes.

Each selling floor is calculated for 900 people and six watts per square foot of floor space lighting load. The beauty parlor is located on the first floor balcony and has separate ducts. Each beauty parlor attendant has a separate control on temperature and can shut off the air supply entirely at her station or direct it away from herself and toward the customer.

There are three refrigeration compressors, two of 300 tons each and a third of 150 tons. Two are used, the third being held as a spare. The water tower is designed to cool 3600 g.p.m. from 99° to 83° with a 75° wet bulb. The present electrical system is d.c. and is being converted to a.c. by the utility. The change to a.c. meant that two transformers had to be installed. The air conditioning apparatus throughout is operated by a.c. motors and there are two 600-kw. transformers. The fan motors can be operated at variable speeds.



The functions of air conditioning as symbolized in a booklet by The Pullman Company.

Modernizing Vacuum Pump Installations

The vacuum pump is often blamed for troubles caused by improper installation of piping. The rearrangement of this piping, which may greatly improve the system's operation, offers another opportunity for modernizing

By V. D. MILLIKEN

ENGINEERS and contractors can develop numerous projects for themselves by giving thought to the following ideas. Some of the projects may be small while others may develop into a fair size job. Large or small, they should all be profitable.

As an integral part of the heating system, and because it is the only moving piece of machinery connected to the system itself, the vacuum pump generally is blamed for many troubles which are no fault of the pump. On the other hand, we frequently hear a statement to the effect that the vacuum pump is operating satisfactorily. By what yardstick is satisfactory operation measured?

If a vacuum pump operates automatically on its float and vacuum control, we may rightfully claim that it is doing all it should do. That is not the point. Is it doing all it *can* do for the heating system? The answer to this question is that many vacuum pumps are *not* doing all they are capable of doing for the system. Why? Because no fully automatic vacuum pump can possibly operate at its highest efficiency, under all operating conditions, unless all condensate flows into the pump receiver by gravity. Wherever vacuum pumps are so installed that condensate does not flow to the receiver by gravity, there is therefore a chance to make a saving and consequently to find modernizing work.

To illustrate this point, just picture a vacuum pump installation having lifts in the return line so that condensate must be raised from the return line to the receiver inlet above. It is a recommended practice to cut out the vacuum regulation and operate the vacuum pump on float control only during the night and also during mild weather. This is good practice, and economical operation is the result, provided system conditions permit the pump to do all it is capable of doing. When the vacuum pump is switched to float control only, it naturally will not operate on float control until the pump receiver contains enough water to actuate the float. By referring to Fig. 1 which diagrammatically represents a system such as described above, it will be noted that the entire return line must become filled with water, to at least the height of the pump inlet, before any condensate can flow into the pump receiver.

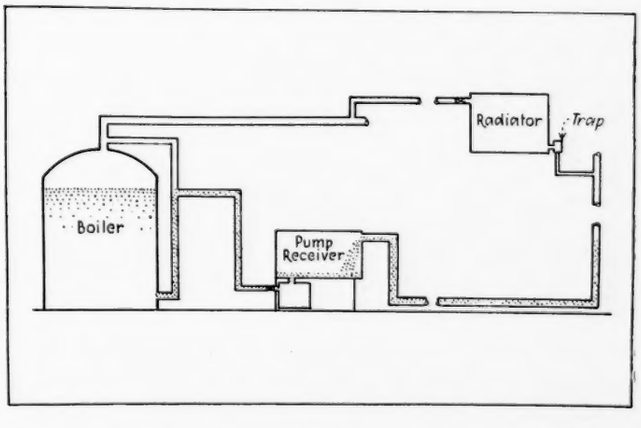
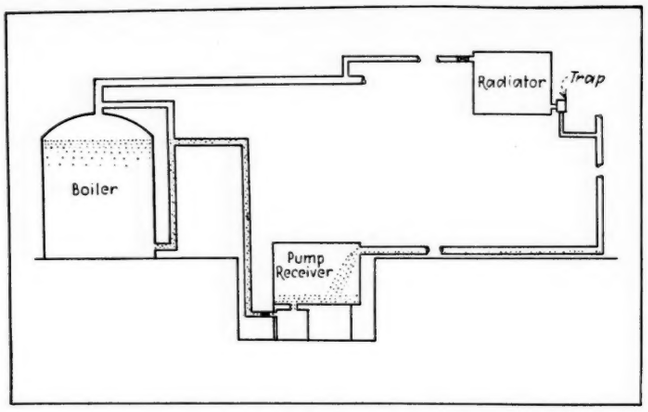


Fig. 1. Incorrect layout. Return line must be filled to height of pump inlet before water flows into receiver.

If the return lines are long, such as is the case in a building covering a large area, a large quantity of condensate will collect in the lines. This causes the water level in the boiler to drop. A boiler equipped with an automatic boiler feeder will have additional water forced into it each time the water level drops sufficiently. Then when the vacuum pump receiver eventually becomes filled, the pump operates and discharges the stored condensate into the previously filled boiler. The system becomes flooded, and hot water must be wasted to establish normal water level again.

The condition just described is annoying and uneconomical, but a worse condition may occur on such systems where the boilers are not equipped with automatic feeders. As the condensate accumulates in the return line the water level in the boiler recedes. The fire is banked and a counter vacuum is formed by condensation of steam in the radiation. Temperature at the radiation is low enough to permit the thermostatic traps to remain open. The result is that there exists a higher vacuum in the radiation than in the pump receiver. The low return line is filled with condensate which seals the line. It is obvious that the greater vacuum on the radiation will not permit the condensate to flow into the pump receiver, and that a head of water, sufficient to overcome the greater vacuum, must be built up in the return line before condensate can flow into the receiver. If air leaks into the pump receiver, conditions become worse, and an even greater head of water must be formed to permit flow. Such a condition is not only annoying, it may become dangerous. The same condition may occur even though the pump has been switched to vacuum control. If the counter-vacuum on the system is greater than the vacuum at which the vacuum regulators are set to start the pump, the pump will of course remain idle. If an equalizing line has been installed between the pump



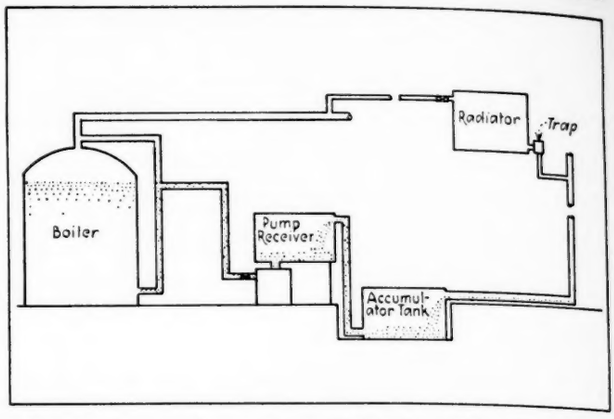


Fig. 2 (Left). Correct installation. All condensate flows by gravity into the receiver. Accomplished by pitting the vacuum pump. Fig. 3 (Right). Alternate method if there is danger of water flooding the pit. Condensate flows by gravity to receiver, permitting return lines to drain.

receiver and the boiler, a differential vacuum will not exist and, consequently, no excess head of water above the inlet of the pump receiver is required to permit flow. The return line remains full of water, however.

With the low return line water-sealed, the air which leaks into the system is trapped, thus air-binding some of the radiation. Proper circulation of steam is impeded. Cold radiators and noise result. The only exit for the trapped air is through the vacuum pump. It is a physical impossibility to remove this air from the system until the condensate is first removed from the low return line. When the vacuum pump is operating on float control only, it automatically stops when all the condensate has been removed, and thus very little if any air is removed. What may happen on such a job is that a vacuum is created on the pump receiver when the pump is in operation. The vacuum increases until it exceeds the vacuum at which the relief valve is set to open. Air from the boiler room is drawn into the pump receiver. The air is then removed from the pump receiver by the vacuum pump and discharged to the boiler room. Thus there is a circulation of boiler room air, but no air from the system is removed. The air handling ability of the vacuum pump is being utilized in doing useless work.

The problem is to make the vacuum pump do useful work on the system, thus obtaining the most efficient operation. The practical way to do this, and at the same time to eliminate water-logged return lines, is to alter the installation so that *all condensate flows by gravity into the pump receiver.* This may be done by pitting the vacuum pump to a sufficient depth to permit gravity flow of condensate as shown in Fig. 2. This will keep all return lines drained, and the vacuum pump will be able to handle air from the system while simultaneously handling the condensate, because the return line will no longer be water-sealed.

If there is danger of the pit becoming flooded with water to a height that would reach the motor, then the following procedure may be used. Install an accumulator tank to a sufficient depth to permit gravity flow of condensate into the tank, as in Fig. 3. The accumulator tank will permit the low return lines to drain, thus preventing relatively large quantities of condensate from being stored in the lines. Unfortunately, however, it does not permit the pump to operate at its greatest efficiency because the condensate has to be lifted.

Referring again to Fig. 3, you will note that the suction connection is into the bottom of the accumulator. The suction connection will be sealed with water as the tank fills. It is obvious that the vacuum pump will not handle air and water simultaneously from the system so long as the suction line is water-sealed. However, the return lines will at least be drained. The condensate from the return line will flow by gravity to the accumulator tank. As the condensate flows into the tank, air will be displaced from the tank to the return line. In other words, the air and the condensate trade places. When the tank has filled with condensate, the float control starts the pump.

It may be necessary to operate the vacuum pump on vacuum control when an installation such as is shown in Fig. 3 is showing evidence of improper steam circulation. When on vacuum control, the cycle of operation is as follows: The pump cuts in at low vacuum. All condensate is first removed from the accumulator tank, after which it is possible to remove the air from the tank and return line. When a sufficient quantity of air has been removed from the system to produce a vacuum equal to the cut-out point of the vacuum regulator, the pump stops. When operated in this manner, it is possible to remove both the air and the condensate.

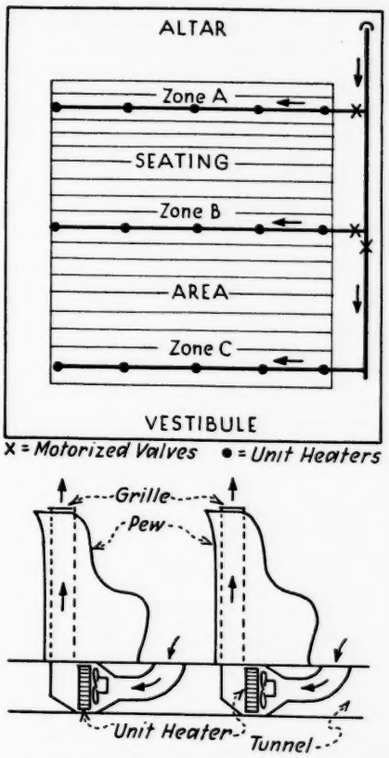
In addition to revamping the vacuum pump installation to secure higher operating efficiency, it is good common sense to recommend stand-by units which may be put into service when trouble occurs. A stand-by boiler, vacuum pump, sump pump, house pump, and other units of the heating system, sewerage system, and water supply system, are extremely convenient and necessary during a shut-down. Aside from the convenience in an emergency, two units may be operated alternately, thus prolonging the life of each. An inspection of the complete heating system may reveal leaks in the return line and fittings, or in valves and radiation on the steam side of the system. Thermostatic traps should be cleaned, or replaced if found to be defective. A little time devoted to such installations should be worthwhile, especially as virtually every engineer and contractor knows where there are jobs which can be modernized if the savings can be shown to be substantial.

Zone Heat, Convectors, and Unit Heaters Modernize Churches

AUTOMATIC zone control of heating systems is one of the best features to sell in pushing modernizing work, particularly in some types of buildings. In colleges, elementary schools, and private estates, there are pronounced opportunities. So are churches and church building groups.

A notable instance of the successful application of church zoning can be observed in connection with some 30 churches in Brooklyn and outer Long Island, installations being sponsored by the Diocesan Building Commission of the Roman Catholic Church. Most of the work is handled by the Hennesey Engineering Corp., Brooklyn.

Heat zoning plans usually consider separately the church edifice, rector's house, auditorium and together the sanctuary, sacristy, and baptistry. When rooms are not in use it is customary to maintain about 55°, although during occupancy 70° is common. All of the foregoing divisions of the church group may have their individual steam supply mains zoned, although there usually is what is called a 24-hr. supply line to the sanctuary, sacristy, and baptistry, in addition to the zoned line. In some instances school rooms comprise another zone.



Arrangement of zoning in a typical Long Island Catholic church shown in the upper view. Below is a schematic view of the use of unit heaters under pews in back rows of cross-aisles and at rear of seating areas.

The particular adaptability of such building groups, as also would apply to colleges, is that certain buildings and/or parts of buildings are in use during only part of the day. By reducing room temperatures automatically under zoning about 25% of the annual heating cost can often be saved, so that the modernization pays for itself over a definite period depending on how precisely zoning is carried out.

In Contractor Hennesey's installations the number of motorized valves installed ranges from three to six per job.

In many instances along with the introduction of zone controls and their necessary thermostats, other heating work by way of modernizing is conducted simultaneously. For example, in the Church of the Queen of Holy Rosary, Roosevelt, L. I., return and supply lines were changed, an oil burner was added, insulation of pipes followed, and numerous convectors and unit heaters installed. Application of the latter most favored by the modernizers is recessing of units. This is effected in several ways depending on their location. When unit heaters are used to heat the main seating section of large churches it is customary to set them in tunnels beneath the floor. Supply air passes to them through small floor grilles, air passes through the heaters and is discharged up through grilles in pew fronts.

In zoning the seating areas of large churches it is customary to divide the seating areas into three sections. Motorized valves control the heat steam supply to each heater bank separately, depending on room thermostats to keep seating-area temperatures as uniform as possible by turning off and on the zone steam supplies. Vestibules are not heated, as a rule.

In the installation at Roosevelt the boiler room is in the basement of the rectory, this being a building of 16 rooms. Steam supply lines then extend from this point to various parts of the church.

For example, the one steam line extends to the column radiators in the principal seating area of the church, while another steam line runs to the living quarters of the priest located upstairs. A third line extends to the sanctuary, sacristy, and baptistry. The last three rooms are heated by convector type radiators. A fourth zone consists of the auditorium which is heated by unit heaters. In installations with schoolrooms these rooms have separate steam lines and a motorized valve and thermostat to control the heating.

Such buildings are adapted to the use of unit heaters in that units can be used for air circulation, thus providing a degree of cooling in summer by simply running the unit fans. Practically all radiators being installed in Catholic churches on Long Island are of the convector type. All thermostats are of the clock type. Automatic fuel-feeding devices such as stokers and oil burners, are being specified by the Diocesan Building Commission in connection with zoned heating.

Although not necessarily specifically adapted to any particular installation, the information above indicates the tremendous market which exists for modernizing in a particular type of structure. How far this can go is also shown by a recent example wherein the confessional box in a Catholic church is kept at a comfortable temperature by use of a unit cooler made necessary by the confining atmosphere of the space.

Forced Draft Modernizes Hotel Plant, Cuts Fuel Bills

AMONG successful engineers who specialize in heating modernization, featuring the cutting of operating cost, is an organization known as Fuel Saving Service, of New York. It is the policy of this engineering firm to solicit contracts from owners of large city buildings and managers of groups of buildings for its service, contracted for on an annual basis. Already some 140 customers have been secured and more are being secured periodically.

The purpose of this engineering organization is purely advisory. Weekly inspections of customers' heating and power plants are made. Suggestions follow as to how customers can reduce their fuel bills by making operation changes, through modernization of old equipment and the addition of new equipment.

One example of this firm's work is that of a hotel of 340 rooms. Two 165-hp., H.R.T. brick-set boilers were in service when the engineers made their initial inspection call. No. 1 buckwheat was being fired by hand under natural draft. Each boiler had 40 sq. ft. of flat grate surface. More than 1000 tons of coal were being consumed per season, both boilers being run over a large part of the winter.

One of the first changes suggested was the addition of two forced-draft fans. It was further suggested that grates be reduced in size to 26 sq. ft. each and that rice coal be substituted. Adopting the recommendations, suitable modernization was carried out.

The fans, instead of being placed on the floor adjacent to boilers, the customary position, were placed on the tops of the boilers, one aim being thus to secure 85° air supply instead of 60° air, the latter being the floor-line temperature. Another object in this fan location was to get the equipment off the floor and thus out of the way of firemen.

Duct from Top to Base of Boiler

From the fan outlets sheet metal ducts were carried to the sides of the ashpits, air delivery being about at the centers of the grates. A feature is a counter-weighted damper at the base of each air supply duct. The air supply thus enters from the boiler room floor when fans are not in use, permitting use of natural draft. When fans are run, air pressure closes the boiler room openings by thrusting the dampers back against the apertures, thus opening the ducts directly to fan-air. Fans are manually controlled.

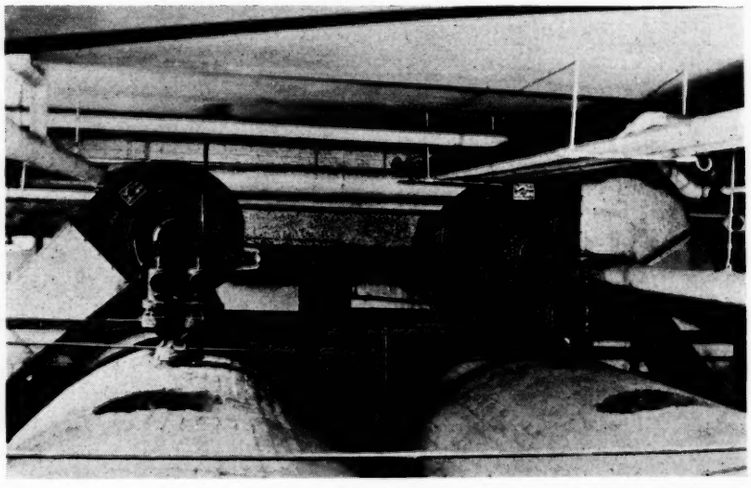
Grate area reduction was effected by laying sheet iron over the rear of grates, covering the sheets with ashes, then advancing the bridge walls some 20 in. The bridge height, however, was not changed. Hand-operated slide dampers were inserted in air supply ducts. Breechings were opened slightly on their undersides and slide dampers inserted. The usual smokepipe dampers were unchanged. The operator by these dampers now can regulate both undergrate draft and overgrate air pressure by intelligent manipulation of dampers. The engineer aims at undergrate air pressure of from ¼ to ¾ in. water gage, and 0.05 in. overgrate pressure.

The operator is guided by two U-tubes on the fronts of the boilers, one being connected to the overgrate sidewall and the other to the side of the ashpit. By watching the U-tubes he can manipulate dampers to attain the desired air pressures.

By changing from No. 1 to No. 2 buckwheat the owners made a base saving of about 75 cents per ton. Tonnage required last winter, as contrasted to the previous winter, was 800 versus 1100.

Heating Now More Satisfactory

Previously the engineer had difficulty in heating the first six floors, now heating is free from criticism in this zone. Steam is generated more quickly, hence individual guest room demand is more quickly satisfied than formerly. Assuming that the cost of the equipment was not earned in a single season by means of the modernization, which it was, it is claimed that the greater heating satisfaction thus secured is deemed worth the cost of the changes. A particular moral that might be drawn is that the group of engineers who run this service have, despite the depression, enjoyed good business and fair income due to their enterprise.



Forced draft blowers mounted on top of boilers in hotel modernization

Practical Pointers on Gas Conversion Installation

ONE of the chief difficulties in converting warm-air furnaces is found to be lack of air supply for furnaces, according to H. J. Leach, a Brooklyn contractor. Rarely is more than a single return air connection found and usually there is none at all for taking air supply either from cellars or from outdoors.

When gas burners are to be substituted for coal grates, this contractor includes in his estimate time, material and profit incident to cutting at least two floor openings—one in the front hall and one in the dining room or living room—placing registers in such openings and running ducts to a fresh air boot at the base of the furnace casing. A single cold air register is not sufficient because of the likelihood of floor drafts that would cause complaints. When possible, he installs a cold air register on the second floor.

Other faults to be overcome, and this applies alike to warm air, to steam, and to hot water plants, are leaky chimneys, leaky smoke pipes, and unnecessary dampers. This contractor meets these problems by making a thorough inspection of all chimneys, removing obstructions, if any, cleaning, and the substitution of 20-gauge aluminum smoke pipes without dampers.

Another precaution that must be taken in installing gas conversion burners is insulating the inner surfaces of the old fuel doors. The average ashpit, firepot and cleanout doors are found to be ill-fitting, hence leaky. Heaters previously oil-fired are said frequently to have warped door plates that must be replaced with new ones.

As to steam and hot water boilers to be modernized with gas burners, the common defect is that gas heat passages are too large. While large passages are appropriate for coal-burning plants in that they serve draft requirements, when gas is used, large passages permit the too-rapid flow of the products of combustion. Stack temperatures are likely to approach 900° instead of 300° to 500°. This contractor states that complex baffling of boilers, while desirable, is not necessary. He breaks a few fire bricks in halves and places them on or in section opening tops partly to close the passages.

Still another difficulty that must be overcome by heating contractors, this on installations previously under automatic control, is in setting of controls and bad wiring. Such work often comes under the general heading of electrical rather than heating work; nevertheless, such corrections, while minor, are important, and can be handled by heating contractors readily.

In regard to room thermostat locations, if the instruments were installed some 10 years ago the chances are they were located six or seven feet above the floor. This contractor brings them down to 4½ to 5½ feet above the floor, preferring the former height. If they are found on outer walls, they are changed to inside walls. If they are above or near heat registers and radiators other spots are selected. Not a few have been diverted from points near fireplaces, space heaters and wall points where heat supply pipes within partitions are nearby.

Exhaust Ducts and Fans Modernize Hotel

NUMEROUS hotels are modernizing equipment involving heating, ventilation, and air conditioning at this time. This work is not confined to any single class of renovizing, but ranges all the way from the boiler room to the roof.

Among the changes being made in residential-type apartment hotels is the addition of kitchenettes and, with them, mechanical ventilating equipment to exhaust cooking odors. In many jobs toilet ventilation is included in both separate and combined exhaust systems. Air conditioning is being installed for grill rooms and bars of these buildings.

Among such installations is one made by Child & Scott-Donahue of New York. This job covers the furnishing and connecting at the tops of 14 individual wall risers of an equal number of electric propeller fans to exhaust odors from 150 kitchenettes and the same number of bathrooms in The Esplanade, a family hotel in New York. When the 12-story building was erected a number of years ago fourteen 2 ft. × 2 ft. ducts were placed within the walls, being connected to all bathrooms and toilets with small individual grilles. It was hoped that natural draft would prove effective in odor removal. Results in this direction never have been satisfactory.

Last year, when 150 new kitchenettes were added, the contractors were asked to install electric exhaust fans on the tops of all 14 stacks.

This was done several months ago with generally satisfactory results. The contract included not only the fans and their controls but ducts from kitchens to bathroom stacks. To round out the equipment fully, spring-controlled, louvered outlet dampers were added, the fan motors being set in horizontal position. The roofs of the stacks were sloped and painted in Spanish fashion, with yellow and red stripes. This decorative treatment harmonized well with the general decoration of the adjacent roof garden.

Another part of the contractor's work in this instance was the replacement of all heating return lines and the installation of a new motor-driven vacuum pump. A feature of this work was the contractor's extensive use of welding, fully one-half of the work being so processed. This method shortened time and labor, particularly in inaccessible places wherein the use of wrenches would have been difficult if not impossible.

Cocktail Rooms Offer Modernizing Opportunities

SINCE repeal, innumerable cafes, grill rooms, cocktail rooms and bars have produced considerable modernization work, particularly as to ventilation and air conditioning. Many of the newer types of place have been added to old restaurants, others to hotels and apartment houses.

Clyde R. Place, consulting engineer, New York, designed and Baker Smith & Company, of the same city, installed recently an excellent example of winter-summer air conditioning for a cocktail lounge known as Mayfair Room in the hotel of this name on upper Park Ave., New York. This was distinctly a modernization project. Construction restrictions as to sufficient duct space offered an interesting condition that had to be overcome. Air circulation was another important problem because the room in question, located adjacent to the sidewalk on the ground floor, is circular in plan.

Fortunately, directly beneath the room there was a large trunk storage space where conditioning apparatus could be mounted on a skeleton-type platform. The refrigeration compressor, due to its substantial weight, was set on a special concrete sub-base on the floor directly beneath the heating and cooling coils and air filter. From a trunk supply duct leading from the apparatus four distributing ducts were extended upward through the ceiling to the cocktail room. Two of these whose outlet grilles are fairly large terminate near the ceiling of the room under treatment. Two smaller ducts terminate on either side of the main entrance, with grilles near the floor. Suitable dampering permits the use of the lower ducts for heating when desired, whereas the upper ducts admit about 1,000 c.f.m. for cooling and dehumidification. The smaller outlets, each supplying 200 c.f.m., that is, those near the floor as aforesaid, when pressed into service during midsummer for cooling, reinforce the conditioned supply to bring the total supply to 2,400 c.f.m.

On either side of the street entrance the architects, Schultze & Weaver, placed small alcoves, to contain one table each. The cool air supply enters through special overhead grilles 42 in. long by 10 in. deep. On the back or concave sides of both alcoves are rather large registers through which room air is exhausted for recirculation, thus making the system largely recirculating. These return-air registers are 3 sq. ft. each and each handles 900 c.f.m.

To secure the necessary duct area to handle the required volume of air, but to conform to the space available between the room and the outer building wall, presented a rare problem in duct shaping. In section, these ducts, as they pass through the floor to the apparatus on the floor below, are banana-shaped, their average width being 8 in. and their maximum dimension 24 in. As might be assumed, sheet metal working skill was required to gather all the varied shapes of ducts already described into rectangular trunk ducts to connect the intake and the outlet of the conditioning apparatus.

Aside from the conditioning equipment outlined, there was also the problem of smoke exhaust. The appropriate place was deemed to be at the end of the room opposite the street entrance. As the bar was convex, two suitable exhaust outlet points were available directly over the bar and in the ceiling near the rear of the area behind the bar. The two grilles thus placed each handle from 300 to 500 c.f.m. and are led to the inlet of an independent motor-driven, cased fan whose maximum air capacity at rated speed is 1,000 c.f.m.

While the Mayfair Room conditioning installation is but a small one, its general characteristics are such that this installation is more or less typical of many others of similar nature that are occupying the attention of heating and ventilating engineers and contractors at this time. A large number of such jobs were put in last year and a number will be installed this year.

Thermal Precipitation of Dust

FIFTY years ago it was shown that dust not only tends to move away from hot surfaces, but also that it is attracted by cold ones and attaches itself to them. This explains a number of familiar things, among others, why the walls and furniture of a stove-heated room are always dirtier than those of a fire-warmed one. In the one case the air is warmer than the surfaces, and in the other the surfaces are warmer than the air. It was demonstrated that the hot surface repels because the outward diffusing molecules are hot and have greater kinetic energy than the inward moving ones; and as the side of the dust particles next the hot surface is bombarded by a larger number of hot molecules than the other side, it is driven away from the hot surface. The cold surface attracts because the outward diffusing molecules have less kinetic energy than the inward moving ones.

Aitken's investigations afford a sufficient explanation of the stains on plaster ceilings which so clearly reveal the pattern of the construction behind the plaster and it is curious how little his work is known and how widespread the idea is that the pattern stains are due to dust left behind by air which has passed through the plaster. That this is a fallacy, however, has been demonstrated by definitely preventing filtration through the plaster by the insertion of a layer of lead foil. This did not make any appreciable difference to the pattern produced on a lath and plaster ceiling. It was pointed out, in 1905, that where the plaster is not backed by a wooden lath, which is a poor conductor of heat, the plaster is cooler and hence the dust leaves the parts where the wood is and attaches itself to the other parts of the surface.—*Journal of the Institution of Heating and Ventilating Engineers.*

VARIATION OF CEILING AND AVERAGE ROOM TEMPERATURES WITH ROOM HEIGHT

(Assuming natural circulation of heated air)

The table on the other side of this sheet is useful for determining both the ceiling and the average room temperatures in rooms where direct radiators are employed for heating and where the temperature at the breathing level is known. It is a well known fact that air stratifies in a heated room and, for any given breathing level temperature, the temperature at the ceiling increases with the ceiling height. This increase is due to a natural tendency of the warmer air to rise. The average room temperature also increases with the room height.

The temperature usually stated in heating specifications is understood to be the dry bulb temperature at the breathing line, 5 ft. above the floor and not less than 3 ft. from an outside wall. This temperature cannot be used to calculate the heat loss through the wall in rooms where the ceiling is over 10 ft. high, for it is not the average temperature. The average temperature will be some figure greater than that at the breathing level. This temperature can be obtained from the table on the other side of the sheet if the room height and breathing level temperatures are known.

It is also necessary to know the ceiling temperature in order to correctly estimate the heat loss through the ceiling if the space above is not heated. Obviously, the average temperature cannot be used for this calculation. The ceiling temperatures for rooms from 10 to 25 ft. are shown on the table.

Suppose that we desire to figure the heat loss of a room with an 18-ft. ceiling which is in a one-story building. The breathing level temperature is to be maintained at 65°. In order to correctly estimate the loss we will have to know three temperatures, the average room temperature to estimate the loss through the walls, the ceiling temperature to estimate the loss through the ceiling, and, assuming the floor is just above the ground or an unheated space, the floor temperature to estimate the loss through the floor.

The first horizontal line on the table shows the breathing level temperatures while the first vertical column shows the various ceiling heights. For the room in the above problem, we use the fifth column which has the 65° breathing level temperature at the top. The first sub-column shows the average room temperatures for various room heights and the second sub-column shows the ceiling temperatures. Since the room has an 18-ft. ceiling, we read the figures appearing in these sub-columns on the line corresponding to the 18-ft. ceiling height. The average room temperature is 70.2° and the ceiling temperature is 81.9°.

The floor temperature is not shown in the table but is obtained by subtracting 5° from the breathing level temperature. This rule may be used in all cases when the space below the floor is unheated and when the breathing level temperature is 55° or above. Using this rule, we obtain a floor temperature of 60°.

The table is based on the rule that in rooms with ceilings under 25 ft., the temperature increases 2% for each foot of height above the breathing level. While this rule is not strictly true, it is sufficiently accurate for most calculations. Experiments reveal that the amount of increase per foot of height apparently decreases slightly as the height increases.

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VARIATION OF CEILING AND AVERAGE ROOM TEMPERATURES WITH ROOM HEIGHT

(Assuming natural circulation of heated air)

CEILING HEIGHT FT.-IN.	50°		55°		60°		65°		70°		75°		80°	
	AVERAGE ROOM TEMP.	CEILING TEMP.	AVERAGE ROOM TEMP.	CEILING TEMP.	AVERAGE ROOM TEMP.	CEILING TEMP.	AVERAGE ROOM TEMP.	CEILING TEMP.	AVERAGE ROOM TEMP.	CEILING TEMP.	AVERAGE ROOM TEMP.	CEILING TEMP.	AVERAGE ROOM TEMP.	CEILING TEMP.
10'-0"	50.000	55.000	55.000	60.500	60.000	66.000	65.000	71.500	70.000	77.000	75.000	82.500	80.000	88.000
10'-6"	50.250	55.500	55.275	61.050	60.300	66.600	65.325	72.150	70.350	77.700	75.375	83.250	80.400	88.800
11'-0"	50.500	56.000	55.550	61.600	60.600	67.200	65.650	72.800	70.700	78.400	75.750	84.000	80.800	89.600
11'-6"	50.750	56.500	55.825	62.150	60.900	67.800	65.975	73.450	71.050	79.100	76.125	84.750	81.200	90.400
12'-0"	51.000	57.000	56.100	62.700	61.200	68.400	66.300	74.100	71.400	79.800	76.500	85.500	81.600	91.200
12'-6"	51.250	57.500	56.375	63.250	61.500	69.000	66.625	74.750	71.750	80.500	76.875	86.250	82.000	92.000
13'-0"	51.500	58.000	56.650	63.800	61.800	69.600	66.950	75.400	72.100	81.200	77.250	87.000	82.400	92.800
13'-6"	51.750	58.500	56.925	64.350	62.100	70.200	67.275	76.050	72.450	81.900	77.625	87.750	82.800	93.600
14'-0"	52.000	59.000	57.200	64.900	62.400	70.800	67.600	76.700	72.800	82.600	78.000	88.500	83.200	94.400
14'-6"	52.250	59.500	57.475	65.450	62.700	71.400	67.925	77.350	73.150	83.300	78.375	89.250	83.600	95.200
15'-0"	52.500	60.000	57.750	66.000	63.000	72.000	68.250	78.000	73.500	84.000	78.750	90.000	84.000	96.000
15'-6"	52.750	60.500	58.025	66.550	63.300	72.600	68.575	78.650	73.850	84.700	79.125	90.750	84.400	96.800
16'-0"	53.000	61.000	58.300	67.100	63.600	73.200	68.900	79.300	74.200	85.400	79.500	91.500	84.800	97.600
16'-6"	53.250	61.500	58.575	67.650	63.900	73.800	69.225	79.950	74.550	86.100	79.875	92.250	85.200	98.400
17'-0"	53.500	62.000	58.850	68.200	64.200	74.400	69.550	80.600	74.900	86.800	80.250	93.000	85.600	99.200
17'-6"	53.750	62.500	59.125	68.750	64.500	75.000	69.875	81.250	75.250	87.500	80.625	93.750	86.000	100.000
18'-0"	54.000	63.000	59.400	69.300	64.800	75.600	70.200	81.900	75.600	88.200	81.000	94.500	86.400	100.800
18'-6"	54.250	63.500	59.675	69.850	65.100	76.200	70.525	82.550	75.950	88.900	81.375	95.250	86.800	101.600
19'-0"	54.500	64.000	59.950	70.400	65.400	76.800	70.850	83.200	76.300	89.600	81.750	96.000	87.200	102.400
19'-6"	54.750	64.500	60.225	70.950	65.700	77.400	71.175	83.850	76.650	90.300	82.125	96.750	87.600	103.200
20'-0"	55.000	65.000	60.500	71.500	66.000	78.000	71.500	84.500	77.000	91.000	82.500	97.500	88.000	104.000
20'-6"	55.250	65.500	60.775	72.050	66.300	78.600	71.825	85.150	77.350	91.700	82.875	98.250	88.400	104.800
21'-0"	55.500	66.000	61.050	72.600	66.600	79.200	72.150	85.800	77.700	92.400	83.250	99.000	88.800	105.600
21'-6"	55.750	66.500	61.325	73.150	66.900	79.800	72.475	86.450	78.050	93.100	83.625	99.750	89.200	106.400
22'-0"	56.000	67.000	61.600	73.700	67.200	80.400	72.800	87.100	78.400	93.800	84.000	100.500	89.600	107.200
22'-6"	56.250	67.500	61.875	74.250	67.500	81.000	73.125	87.750	78.750	94.500	84.375	101.250	90.000	108.000
23'-0"	56.500	68.000	62.150	74.800	67.800	81.600	73.450	88.400	79.100	95.200	84.750	102.000	90.400	108.800
23'-6"	56.750	68.500	62.425	75.350	68.100	82.200	73.775	89.050	79.450	95.900	85.125	102.750	90.800	109.600
24'-0"	57.000	69.000	62.700	75.900	68.400	82.800	74.100	89.700	79.800	96.600	85.500	103.500	91.200	110.400
24'-6"	57.250	69.500	62.975	76.450	68.700	83.400	74.425	90.350	80.150	97.300	85.875	104.250	91.600	111.200
25'-0"	57.500	70.000	63.250	77.000	69.000	84.000	74.750	91.000	80.500	98.000	86.250	105.000	92.000	112.000

Table by HARRY R. ROE, *Detroit*

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Design, Installation, and Operation of an Institutional Heating Plant

3. The Extensive Steam Distribution System at The University of Texas

By CARL J. ECKHARDT, Jr.†

STEAM is generated at The University of Texas for heating, utility, domestic, and experimental purposes. The institution has experienced an extraordinary physical plant growth, and with the passage of time its steam distribution system has been extensively developed to meet demands continuously increasing both in magnitude and in number. The total amount of steam distributed per year has grown to approximate 200,000,000 lb., the greatest portion of which is used for heating purposes. Approximately 70,000,000 lb. are used annually for utility purposes. In dormitories and cafeterias steam is used for cooking and hot water heating purposes. In the science laboratories it is used in stills, sterilizers, and autoclaves. In engineering laboratories this service is required for experiments.

Development of this distribution system has involved many problems of design and construction. The present system involves about nineteen miles of pipe lines. These lines are confined to an area which is at no point more than three thousand feet removed from the institution's central heating plant. The difference in elevation between the point at which the distribution lines leave the plant and the highest point at which steam is provided, however, exceeds three hundred feet.

Old Steam Lines Inaccessible

In Fig. 1 a plan of the campus of The University of Texas in 1926 is shown, with the steam distribution system diagrammatically indicated. Steam distribution lines to the majority of the buildings had been placed in underground conduits where they were not accessible for inspection, maintenance, or repairs, and the layout of the system involved the use of no particular development plan. Provisions were made to supply each building as a separate and individual project which had little, if any, relation to the ultimate nature of the system as a whole. From a comparatively few points radial feeders extended to each individual building. Use of low-pressure steam lines for this purpose necessitated the use of comparatively large pipe sizes in order to maintain moderate velocities because of the comparatively large specific volume of the steam at the low distributing pressure. The inflexibility of the design employed precluded the possibility of the operating organization rendering a service without frequent serious interruptions.

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As soon as the extensive development of the physical plant of the University seemed assured, the institution's engineers began to prepare plans for development of this highly important utility. In the short period of six years, 14 large structures were to be constructed on the main campus. Definite policies were soon formulated for the procedure to be employed in extending the existing system to meet these rapidly increasing requirements as well as to fit the existing and contemplated extensions into the general schematic arrangement of physical plant development.

Complete Rehabilitation Needed

The preliminary study revealed the fact that the existing system needed to be completely rehabilitated. The demolition of many temporary structures during this period made possible the abandonment of the weakest portions of the system. Each successive step in this rehabilitation program was planned in such a fashion that upon the completion of the various independent projects the condition of the system as a whole would not only be such as to meet the immediate requirements imposed, but also such that subsequent extensions might be made with greatest facility and economy. The construction of a new central heating plant made possible the use of a higher distribution pressure, which in turn made possible the use of fewer and smaller piping systems. The plan developed, furthermore, involved the construction of a basic tunnel system for main distribution arteries and the use of branch conduits for steam lines extending from the main distribution system to separate buildings.

Fig. 2 shows a plan of the campus in 1933 and reveals the extent to which this utility had been improved in the intervening seven years. The main campus was completely looped with the basic distribution system which is operated at a pressure of 200 lb. per sq. in. The inclusion of this system of piping in tunnels made possible constant inspection, maintenance and repair operations. The arrangement used, furthermore, precluded the possibility of a single fault interrupting the steam service to any great number of buildings. Use of this loop and a series of sectionalizing valves made it possible, when a fault occurred, to close the nearest sectionalizing valve on each side of the fault. In this manner the service only to buildings having take-offs between the two closed valves was interrupted while all other buildings suffered no

such interruption in service. A further inspection of the plan shows that subsequent developments will complete two additional loops of this nature.

The new system not only greatly reduced the number of radial feeders, but it also generally provided steam for each building by the most direct route with the consequent minimum transmission loss. The length of the feeder lines, which were alternately expanded when the heat was turned on and contracted when the heating service for a building was discontinued, was greatly reduced. The unfortunate circumstances by which the distribution losses were frequently greater than the amount of steam effectively utilized were entirely removed. A material reduction in total heating costs resulted from this improvement in the nature of the steam distribution system.

Preparation of distribution system plans was soon accompanied by the inevitable "tunnel versus conduit" considerations. Each type of construction was regarded as having a very definite field for proper application. Consideration of the following factors in the selection of the structure employed to house steam distribution left little, if any, room for speculation as to whether a tunnel or a conduit should be used:

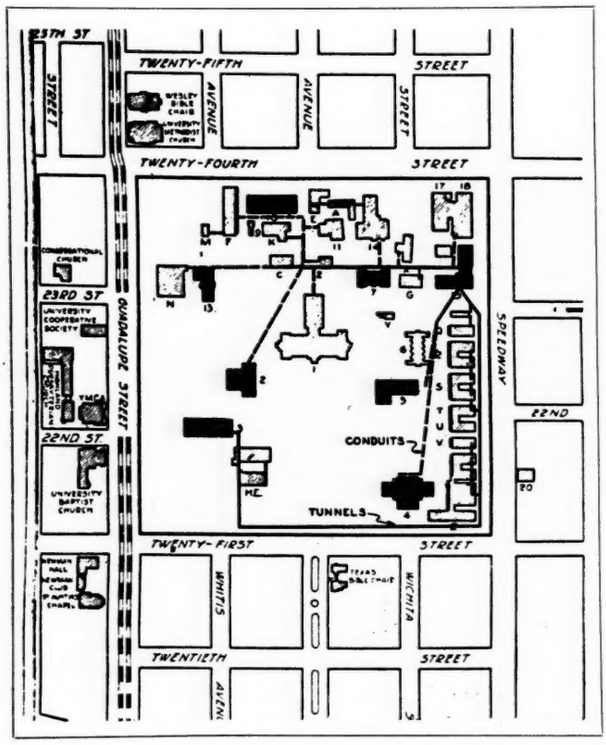
Nature of the terrain on the site of the system; number of services to be rendered; operating pressures and temperatures; nature and extent of the existing system; arrangement of buildings and their proximity to the generating station; piping fabrication processes; nature of the services required; importance of rendering a continuous service; probability of future extensions, and probability of greatly increased demands.

Fortunately the University had previously constructed tunnels and conduits of various types. Past experiences had definitely indicated that tunnel construction was a much more expensive type of construction than that in which conduits were involved. The same experiences indicated that in a number of cases the use of conduits had definitely proven to be improper. The use of this type of construction because of its lower first cost without any regard for other equally important considerations had ultimately proven to constitute a most disastrous policy. For the foregoing reasons great care was exercised in designing the rehabilitated system to use each type of equipment in such places as an intelligent consideration of attending circumstances indicated its use to be proper.

Early tunnels at the University involved the brick type of construction. Later tunnels had been constructed of reinforced concrete. A study of previous operating records revealed that seepage problems were materially reduced by the use of concrete construction. The proper backfilling and waterproofing operations were naturally regarded as being of vital importance to the best possible construction of each type of system. A further study of past experiences revealed that the concrete type was better adapted for securely fixing supporting structures for pipe supports, guidance members, and anchorages. For these reasons a reinforced concrete type of construction has been used in the case of all recent tunnels.

The headroom provided in such tunnels has in all instances been 6 ft. 6 in. The interior width of the tunnel has in all cases been made 6 ft. Of the cross-sectional area one-half of the included space has been used for piping systems and the remaining space has been left as unobstructed walkway.

Interior structural supporting members have been



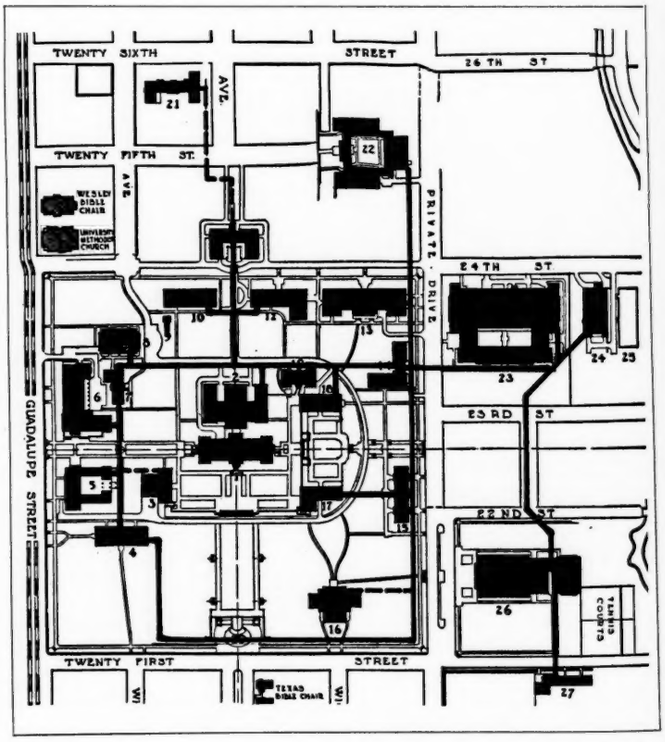


Fig. 1 (Left). Steam distribution system of The University of Texas as it appeared in 1926. Fig. 2 (Right). The steam distribution system as it appeared in 1933. In both drawings the tunnels are indicated by solid lines, conduits by dashes.

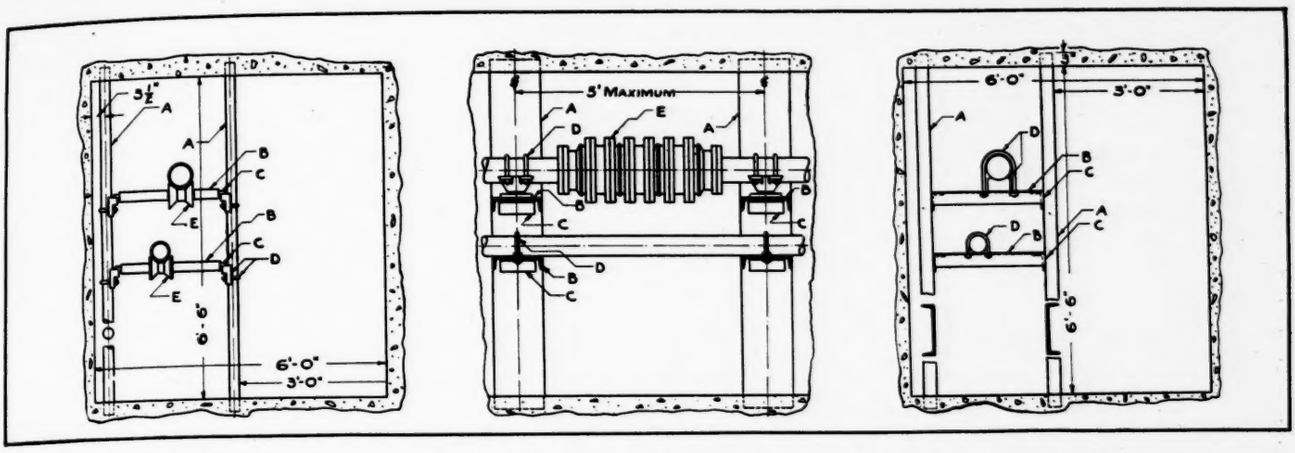


Fig. 3 (Left). Typical tunnel pipe rack. A is a 2-in. G.I. pipe vertical support; B a 2-in. G.I. pipe spacer; C a 1 1/4-in. G.I. pipe cross support, and E the pipe roller. Fig. 4 (Center). Expansion joint assembly. A and B are of 12-in. channels; C is of 3 x 4 x 3/8-in. angles; D the pipe guide, and E the expansion joint. Fig. 5 (Right). Pipe anchorage assembly. A, B, and C are of the same materials as in Fig. 4. D is the pipe anchor.

placed in the forms before the concrete has been poured in order that subsequent perforations of tunnel floors and ceilings might be reduced to a minimum to avert later seepage difficulties.

Pipe supports are placed at 10 ft. intervals throughout the tunnel systems except where anchorage or guidance members are located. The proper guidance of pipe lines was regarded as being highly essential to the preservation of expansion members. Guidance members have been placed at 30 ft. intervals in the tunnel systems. The maximum distance between the guidance structures on the two sides of expansion members is 5 ft.

Simple U-bolt guides having an opening greater than the diameter of the enclosed pipe have been used in the case of return lines because the low temperatures at which they are operated have involved no great movement. More elaborate guides are used for pipe lines operated at higher pressures and temperatures. These universal guides have specially prepared sliding surfaces which permit longitudinal movement, but do not permit any lateral movements. By the use of proper set screws the grade of the pipe may accurately be preserved at such guidance structures.

Anchorages have been carefully designed and constructed to assure the proper operating conditions for expansion members. In the case of simple low-pressure or return systems involving a small pipe movement U-bolt anchors having interior surfaces considerably flattened and accurately fitted have been used successfully. High-pressure steam lines have, however, required a more elaborate and secure type of anchorage design. Such anchorages involve the use of two saddles between which two U-bolts are securely fastened.

Designing engineers were further fortunate in having at their disposal operating, maintenance and repair data of steam distribution systems placed in concrete and vitrified glazed clay tile. The latter type of construction has been used in the latest conduit structures. The design of underground steam distribution systems in conduits involved four problems of a major nature, namely, the proper insulation of the steam pipes, the protection of the pipes and their insulation from water and mechanical damage, the drainage of condensate from the steam distribution lines, and the provision of proper anchorage structures and expansion members.

The advantage in using this type of construction comes largely from the fact that the clay tile conduit, its underdrain, the insulation in which the distribution lines are packed, as well as the pipe supporting and guidance structures are offered for sale as a whole by manufacturing organizations which have carefully developed this material for the use for which it is intended.

The steel steam mains have in all instances been sized to permit the distribution of the required steam at moderate and safe velocities. In instances in which

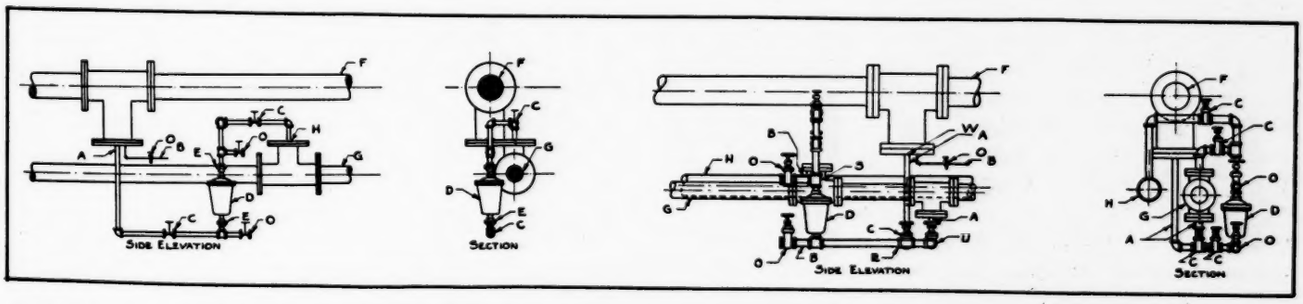


Fig. 6 (Left). Simple drip trap assembly for single return line. Fig. 7 (Right). Drip trap assembly for double return line. In both of these the line A is extended 2 in. inside the drip pocket; B is a blow-off line; C a gate valve; D, traps, and F a steam line.

the grade of the pipe has been such as to permit condensation to flow in the same direction as the steam, the velocities have been confined to values no greater than one thousand feet per minute per inch of internal pipe diameter. Throughout a great portion of this distribution system the condensate must, due to the grade of the steam mains, flow countercurrent to the steam. In such instances, in order to secure proper drainage of condensate, steam velocities have been confined to values no greater than seven hundred and fifty feet per minute per inch of internal pipe diameter. At such velocities little difficulty has been experienced in properly draining steam distribution lines of condensate even though in places the grade of a 1000-ft. long line is such as to place its terminal point 50 ft. above its initial point. Wrought-iron return lines have been liberally sized. The greatest portion of the condensate flows back to the central heating plant by gravity.

In this system four principal types of expansion joints have been used. The pipe bend has been regarded as a most desirable expansion member. It has, when used, involved a considerable first cost, but the fact that its subsequent maintenance and repair cost are negligible frequently makes this type of expansion member the most logical to use. Variators having corrugated expansion members designed to resist corrosion and tempered to permit long lived operation under conditions of repeated movement without fatigue have been extensively used because they could be applied in the case of rehabilitated lines in existing tunnels. Ordinary slip type of expansion joints have also been used with more than a reasonable success due to long traverses and proper packing.

Two distinct types of drainage systems have been used to remove condensate from steam distribution lines. The less complicated of these is illustrated in Fig. 6. This type of drainage arrangement is used in the remote sections of the steam distribution system.

This assembly involves the use of a liberally proportioned drip pocket in the steam main. To avert the possibility of accumulating foreign material in the drip trap, the condensate is removed from the drip pocket by a pipe having a long running thread which permits the draining pipe to extend up into the drip pocket several inches. Provision for the removal of such foreign material from the drip pocket is made in the form of a suitable blow-out line which terminates in a suitable gate valve. The drip trap proper is provided with suitable test and blow-out lines and valves. In such places the high-pressure condensate is discharged directly into the low-temperature condensate line.

In Fig. 7 is shown a more complicated drip trap assembly. This drip trap assembly is extensively used throughout the system where justified.

Under winter operating conditions the low-temperature return lines are used to return the condensate from building heat emitting members back to the plant. The drip trap by means of which condensate is removed from the high-pressure steam main discharges the condensate which it accumulates into the high-temperature return line.

In the off-heating season period the steam distribution lines are operated at pressures lower than 200 lb. per sq. in., the normal heating season steam main pressure. Some saving would be effected by the distribution of steam at a lower pressure through the same mains due to the correspondingly lower temperatures and consequent lower radiation losses. The size of the high-temperature return main is, during the period of the year when no buildings are heated, large enough to distribute the required amount of steam. The cross connection of the drip trap assembly can, therefore, by proper valving operations be so arranged that it will remove the condensate from the high-temperature return line and discharge it into the low-temperature return line. The large high-pressure steam main may then be taken out of service. The surface exposed to radiation and convection losses in the case of the high-temperature return line is only one-third as great as that of the main steam distribution arteries. This effects considerable savings.

The University is at the present time preparing plans to increase the size of its large distribution steam mains and for the installation of a bleeder line from its central station to a point in its distribution system at which four large buildings may be heated with steam extracted from its bleeder-type power generating units. During the off-heating season period the entire steam required outside of the generating station will be bled from the bleeder-type turbines. During the heating season the heating system of four large buildings and the requirements of open and closed feedwater heaters within the plant will provide an adequate bleeding load on these turbines to permit the generation of power as a byproduct throughout the year.

Ventilating problems experienced in the operation of extensive tunnel systems have from the economic aspect always presented a difficult problem. In order that these tunnels may be maintained at temperatures sufficiently low to permit the operations required of the operating organization, definite ventilating openings have been provided in the high portions of the tunnels to permit the circulation of a sufficient amount of air by convection from the lower tunnel reaches to lower the tunnel temperatures to values no higher than 160°. This action very naturally results in an irretrievable and deleterious heat loss. Experimental work is now being conducted to make possible the utilization of this heat. Steam is generated in the generating station by the combustion of a fuel which by weight consists of more than 30% moisture. It is highly probable that the above mentioned experiments will demonstrate the commercial feasibility of using a mechanical ventilating system to reverse the direction of flow of air through the tunnel systems in such a manner as to discharge the heated air at the generating station at which suitable drying apparatus can be devised for the purpose of drying the fuel in a preparatory process to reduce the heat loss due to moisture in the fuel.

The steam generating station, which is modern in every detail, can readily be adapted to this arrangement as soon as suitable driers have been developed.

In the next of this series of articles the steam generating station will be described.

Contractors Condemn Force Account Work

on Federal relief jobs, endorse principle of installing only equipment they sell, and hold session on trade promotion at their 46th convention

REACHING an attendance of nearly two hundred the 46th annual convention of the Heating, Piping and Air Conditioning Contractors National Association reflected the new spirit which has come to the contractor because of the better volume of business in the past year. The sessions, which were held at the Hotel Gibson May 19-22, were all crowded with interesting papers and discussion to an extent not duplicated in recent conventions of the association. The organized contractors are evidently keenly aware of the problems with which they are faced and determined to find suitable solutions.

Following the opening formalities, the chair invited W. H. Driscoll, representing the A.S.H.V.E.; N. E. Garrett, representing the United Steam Fitters Association, and H. B. Gombers, secretary-emeritus, to address the convention. Mr. Driscoll asked for cooperation between the association and the society, while Mr. Garrett referred to the friendly relations which have existed between the association and the labor organization of which he is an active head. Mr. Gombers was on hand to meet his many old friends and associates.

In the report of the national headquarters Acting Secretary S. Lewis Land pointed to the success of the modernizing program being carried on under Title I of the National Housing Act. In Mr. Land's opinion the association's program of Certified Heating will take on new life when Title II covering residential construction gets actually under way. He referred to the subject of distribution differentials and objected to a customer classification by name rather than by service.

Prof. H. H. Maynard of Ohio State University—a professional economist—held the attention of the convention for over an hour with his interesting experiences as member of various NRA code authorities. Discussing his subject "Can Business Govern Itself?" Professor Maynard was of the opinion that it is doubtful if this is possible through a set-up such as NRA. He was of the opinion that trade associations would be found to be increasingly necessary if business were to have self-government.

Following Professor Maynard's address Mr. Zink reported on his work as Washington contact man for the association and in the course of his remarks expressed the opinion that he did not see how business could govern itself except through some agency similar to NRA. He doubted if trade associations, lacking governmental authority, could find effective means for keeping their members in line.

Resolutions were presented placing the association on record as not being in agreement with the recent pronouncement of the U. S. Chamber of Commerce. Moreover the association passed a resolution favoring a two-year extension of NRA and approving of the principles of that organization. Adjournment was taken following a memorial address by Robert D. Williams, New York, for members who died during the year.

Monday afternoon was devoted to golf and to a sightseeing trip to points of interest in Cincinnati. Large amounts of rain seemed to have no effect on the enthusiasm of the golfers, although discussions of the scores were rather subdued. On Monday evening a Dutch party was held on the roof garden of the hotel. The garden was decorated to represent a German beer garden with all the trimmings, including a five-piece German band of the pre-war variety.

Tuesday morning session was devoted entirely to a discussion of trade promotion except for the report of the committee on Certified Heating.

Sixteen local associations reported a total of over 10,000 heating jobs which have been certified since this program was inaugurated in 1929, according to the committee on Certified Heating. It is believed that a large portion of the jobs certified in recent years have been modernization projects. The committee on Certified Heating is headed by J. P. Baldwin.

J. Lawrence DeNeille, reelected president of the Heating, Piping and Air Conditioning Contractors Association.

Herbert A. Snow, chairman of the committee on trade promotion presided and introduced Russell G. Creviston, director of advertising and sales promotion for Crane Company. Mr. Creviston in the feature address of the morning raised many questions regarding present trade promotion practices and challenged the contractors to find suitable answers to them. His paper "Sales Promotion From the Point of View of the Manufacturer" was intended to be stimulating and thought-provoking. Mr. Creviston proposed no solutions as he felt that the solution should be in the hands of the contractors themselves. H. O. Nelson, Detroit, discussed "Sales Promotion from the Point of View of the Wholesaler." He pointed to the evident function of the wholesaler in maintaining stocks and simplifying the credit problem of the manufacturer. He was of the opinion that the program of sales promotion and distribution would have to recognize the necessity of the wholesaler in the general scheme. Justin A. Kiesling devoted his paper "Sales Promotion from the Point of View of the Contractor" largely to a discussion of methods which his own firm has found successful. His firm has become a dealer for one of the large air conditioning manufacturers and he called attention to the necessity of conducting such activities along quite different lines than are usually followed by the contractor. He pointed out that the ordinary price differentials with which the contractor is in the habit of dealing are wholly inadequate in promoting the sale of equipment of this kind under prevailing conditions. He advocated that contractors keep an open mind and approach the subject of dealerships and franchises with a view to finding out the real facts and following the line of their own real interests.

At the Tuesday afternoon session the whole question of the NRA code and its administration was thrown open for general discussion. At this meeting—the first open meeting since the code went into effect in August, 1934—a great many detailed suggestions for amendment of the code itself and other changes in procedure were made. R. B. Miller, secretary of the New York association, presented a list of 14 proposals representing changes in wording and in procedure aimed to close up loopholes which have been found to exist. These were so vital and brought

forth so much discussion that it was necessary to consider them item by item. This consideration occupied virtually the whole afternoon with the result that the divisional code authority received a long list of suggested changes for detailed consideration and for presentation to NRA with a view to securing adoption of as many as possible.

Strong objection was voiced to the administration's proposal that the government conduct public works under the new $4.8 billion relief program by means of force account instead of letting contracts and inviting open bids.

In view of the interesting situation in Chicago, William V. Hoier was asked to discuss the high-points for the information of those in attendance. He felt that the turning point in compliance in the Chicago district was reached when union labor decided that its members could not work except on projects where NRA provisions were being complied with. He stated that when labor took action the effect on compliance was almost instantaneous.

A. C. Rodoni, San Francisco, explained the bid depository plan used there and which seems to have worked out in especially satisfactory fashion.

The annual dinner-dance of the association occupied Wednesday evening and marked the high-point of the entire program.

After calling the convention to order on Wednesday morning President DeNeille asked for the report of the membership committee. In the absence of Maurice G. Chagnard, the formal reading of the report was dispensed with but it was noted that there was a 16% gain in the membership of the association.

The president then called on A. R. Herske, New York. Mr. Herske greeted his many former associates in the association and called attention to the benefits which membership bestows.

The committee on standards of the association has been working during the past year on three different engineering standards covering tables of pipe sizes for forced hot water heating; engineering data on mechanical refrigeration, and the revision and expansion of Part V of the engineering standards. According to the committee, headed by George P. Nachman, no additional material has been published on this subject since in some of the fields materials and methods are rapidly changing.

In addition Mr. Nachman outlined a method of cooling and heating for the fine residence of the future. He felt that advantage would be taken of the principles of radiant heating by panels for use in the winter with convection used for summer cooling. He stated that his firm had already done considerable work along such lines and felt justified in predicting that such methods would find increasing use.

Following this report President De Neille introduced M. J. Beirn, vice-president and general manager of sales, American Radiator Company. In an excellently prepared paper Mr. Beirn summarized the facts concerning the shortage of housing brought about by the lack of construction in the past few years, and contrasted this with the tremendous activity of similar construction in England. He also called attention to the volume of work made possible by the newer financing methods including the three to five-year repayment plan of FHA with the insurance feature, and to the rising popularity of the amortized mortgage. Mr. Beirn felt that instead of feeling discouraged at the prospect the entire heating industry should feel greatly encouraged, and that prospects were really better than they had been in many years.

In the report of his committee on boiler output, Harry M. Hart, the chairman, reviewed the methods being used by the committee in establishing net load recommendations for heating boilers and referred to the movement under way in standardizing sizes of horizontal steel firebox heating boilers. Mr. Hart reminded the members that the association will be asked to vote on the acceptance of these standards by the Department of Commerce. It was pointed out that if these proposed standards are adopted, the work of the committee on boiler output will be simplified.

The committee on air conditioning, through its chairman, H. E. Wetzell, stated that commercial buildings still remain the contractors' best source of air conditioning business. The report emphasized the work being done by the association in connection with keeping the members informed on air conditioning engineering, and said that a constant effort has been made by the members of the committee to maintain the proper relationship between the air conditioning manufacturers and contractors so that the merchandising of this equipment will be through contracting channels. According to the committee there is now a definite demand for certified air conditioning, but the committee went on to report that methods of calculations will have to be national in scope, and standards will have to be established for each section of the country. The committee claimed that the heating and piping contractor is being recognized as the logical group to carry on air conditioning work.

Following the report of this committee George H. Dickerson, Chicago, spoke on the subject of certified air conditioning, as recently set up in Chicago. The association went on record as endorsing the standards set up and commended the Chicago movement.

At this point Mr. Rosenwald, of the U. S. League of Building and Loan Associations, appeared before the convention. Mr. Rosenwald was attending a meeting of the League which was being held also in the hotel. He stated that the figures presented by Mr. Beirn were in substantial agreement with the figures collected by his own organization and that he thoroughly concurred that now is the time to be optimistic. He pointed out that the building and loan associations are now prepared to make loans in all sections of the country and that they are actually doing so.

Taking as his subject "What's Involved in the Sale of Air Conditioning?" J. J. Nance, manager of air conditioning division, Frigidaire Corporation, made a strong plea for recognition of the importance of consumer education in air conditioning. Mr. Nance pointed out that the ultimate person to be satisfied is the consumer and that he must be brought to a realization of just what performance he may expect of his equipment. If he is led to expect too much the inevitable result will be disappointing and a black eye for the installation.

A series of nine resolutions was presented, many of which had to do with routine matters. Two of these resolutions, however, were of widespread interest because of the important subject matter covered. One—adopted as Resolution 7—contained the following:

"Resolved, That it is to the best interests of the industry that no Heating, Piping and Air Conditioning Contractor will install any equipment that is not sold through the contractor making the installation.

"It is further recommended that each local association pass a similar resolution and take proper steps to enforce it."

The other, adopted as Resolution 8, commended the efforts being made to secure proper recognition for the contracting industry under the Works Relief Bill, making use of the following language:

"Whereas, The Congress of the United States has appropriated large sums of money to relieve distress and furnish funds to provide employment for men in construction and repair work of Federal, State and other projects; and

"Whereas, In construction and repair of many of these projects the organizations having charge of same do the work on force account and it is necessary to purchase tools and equipment and to provide purchasing, accounting, superintending, and other departments; and

"Whereas, The work performed by such Federal, State and other organizations on forced accounts deprives men and firms established in various crafts of the construction industry of the opportunity to secure this work by contract or forced account; and

(Concluded on page 66)

GETTING DOWN TO FUNDAMENTALS

3—Figuring Filtration Heat for Estimating Purposes

Foreword

IN previous articles in this series the nature and direction of flow of the heat quantities on which the usual estimate is made have been described. They were shown to be divisible into (a) transmitted heat, (b) heat from filtration air, and (c) heat from ventilation air. It was also noted that these quantities can be expressed mathematically in the following equations:

$$\text{Transmitted Heat} = H = AU(t_i - t_o) \quad (1)$$

$$\text{Heat from Filtration Air} = F = \frac{C(t_i - t_o)}{55} \quad (2)$$

$$\text{Heat from Ventilation Air} = V = \frac{C_v(t_i - t_o)}{55} \quad (3)$$

In these equations: H, F, and V are all in B.t.u.'s per hour:

A = Area, sq. ft. of surface through which heat passes
U = The transmission coefficient, air to air
C = Volume of filtration air flowing, cu. ft. per hr.
C_v = Volume of ventilation air flowing, cu. ft. per hr.
t_i = Temperature of indoor air, °F.
t_o = Temperature of outdoor air, °F.
1/55 = 0.018 = heat to raise 1 cu. ft. of air at 70° 1°

It was also noted that the three equations are not usable until values are available for substituting in them.

In the last article the fundamentals of arriving at suitable values of t_i and t_o were discussed and tables were presented showing what values may be used in the equation.

Since the inside and outside temperatures are the only terms common to all three of the equations, it is necessary to consider each of the others separately. A suitable way is to take up the equations one at a time. We will now do this, giving first consideration to equation (2) and to the whole subject of estimating the heat quantity involved in the movement of filtration air into and out of a building.

As actually applied, equation (2) is used in two different forms, and two separate methods of calculation resting on these two forms are in fairly common use. Before discussing the methods it is convenient to show the two forms of equation (2).

We have written the equation heretofore as

$$F = \frac{C(t_i - t_o)}{55}$$

Recall, though, that the figure 1/55 which equals 0.018 is the heat required to raise 1 cu. ft. of air at 70° through 1°. Evidently this figure is obtained by multiplying the specific heat of air which is 0.24 (sensibly a constant at ordinary temperature) by the density of air at 70° (0.075). The equation can therefore be rewritten in more general terms in the form

$$F = C \times 0.24 \times d(t_i - t_o) \quad (2a)$$

where d is the density of the air. Since density is a fixed quantity and constant at any given temperature, the value which must still be fixed before applying the equation is C, the volume of filtration air passing through the building at the time of the peak heating or cooling load.

In the first article of this series it was pointed out that the quantity of air passing through the building depends on the direction and velocity of the wind, on the type of building construction, building material used, the tightness of construction, and secondarily, on the height and exposure of the building. The result of all these factors is that a certain volume of air passes through the building.

The two methods used in practical calculation depend on the way in which the volume is arrived at. One is commonly called the "air-change" method and the other is the "window-leakage" method.

In the air-change method, which is much the older of the two, the value of C is found by measuring the volume of the space being calculated and multiplying this by a factor found from tables based on experience. If v is the room volume (cubic feet) and n is the value assigned as the number of "air changes" per hour, the equation (2a) can be written:

$$F = n \times v \times 0.24 \times d\ (t_i - t_o) \quad (2b)$$

Calculations by the window-leakage method make use of "leakage factors" which are found by trial. It is assumed that the quantity C is made up by air which finds its way through cracks, principally around windows. Values for the amount of such air are usually given in tables on a "cubic feet per hour per linear foot of crack" basis, at various wind velocities. This figure is called the "leakage factor." With such a figure the quantity C is found by multiplying the cubic feet per unit of crack length by the number of feet of crack exposed to the wind. Equation (2a) can then be written as follows:

$$F = L \times P \times 0.24 \times d(t_i - t_o) \quad (2c)$$

where L is the leakage factor and P is the perimeter (feet) of the crack around the windows exposed to the wind.

In the minds of many there seems to be a strange assumption that there is something inherently more accurate about calculations based on the "window-leakage" method than on the "air-change" method. A clear understanding of how the two methods compare in inherent accuracy can be gained by comparing equation (2b) with equation (2c). Their relative terms are made evident at once by setting them side by side, thus:

$F = n \times v \times 0.24 \times d(t_i - t_o)$ — air-change method
$F = L \times P \times 0.24 \times d(t_i - t_o)$ — leakage method

Inspection shows at once that they are identical ex-

TABLE 1

VALUES OF LEAKAGE FACTOR (L IN EQUATION 2C)
AND B.T.U. PER HR. PER FT. OF EXPOSED WINDOW CRACK

(Temperature difference of 70° for use in estimating winter Loads)

1	2	3	4	5	6	7	8
Method of Support	Sash Material	Wind Protection	Construction Features	Fit or Condition	Perimeter (P) in Ft.	Leakage (L) Cu. Ft. per Hr. 15 M P.H.	L x 1.25 B.t.u. per Ft.
Double Hung or Casement	Wood	None	Usual run of Millwork and Hand-Work on site	Average Tightness (Unlocked)	For Double Hung three times the Width of Sash plus twice Height of Window. For Casement total Length of crack	40	50
	Wood	Weather Stripping				24	30
	Wood	None		Poorly Fitted (Unlocked)		110	140
	Wood	Weather Stripping				34	43
Double Hung	Metal	None		Unlocked		75	95
	Metal	Weather Stripping				31.5	40
Rolled Section Steel Sash							
Industrial Type { *With Ventilator horizontally pivoted, lower part swinging out*					Use perimeter of Swinging Section only	175	220
School & Public Bldg. { *Sections heavier than above, Ventilators balanced on side arms.*						90	113
Residential Casement						50	63
Heavy Section Casement						40	50

cept insofar as the terms n, v, L, and P are concerned. The term v is dependent on the room dimensions and can be measured with as much accuracy as desired. The same is true of the term P which is a physical quantity and can be directly measured. Fundamentally, therefore, there is no choice as between the strictly inherent accuracy of the two methods. The whole question of accuracy in practice must consequently revolve around a consideration of the relative accuracy of the values of L available for use and those of n, the number of air changes.

Let us now turn attention to the present state of the data for determining values of L and n and also to a consideration of the relative ease of application of each method.

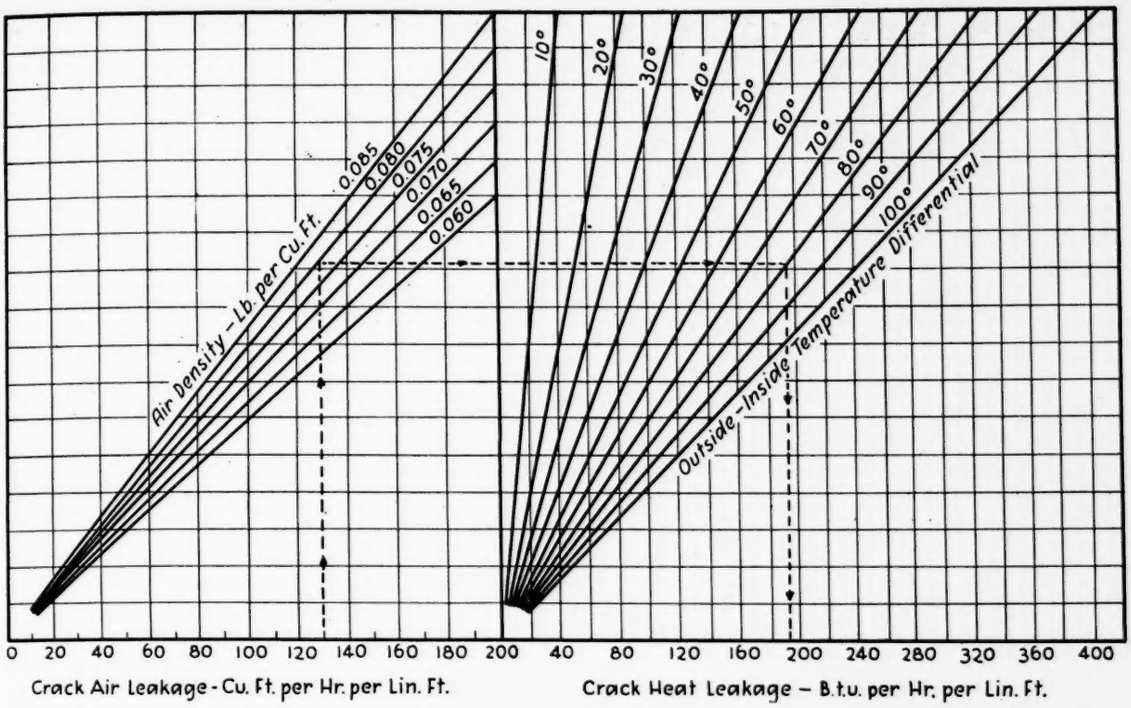
Tables showing values of L have been prepared as the result of laboratory studies in which windows are constructed within a pressure chamber. Air is forced against one side of the window and the amount which finds its way through the window construction is measured. As the amount varies with the type of window used and with the quality of workmanship, it is necessary to test windows of many kinds and constructions. Enough window types have been studied so that tables are in existence which give values of the "leakage factor" over a considerable range.

In attempting to make use of such tables it is necessary to decide on (a) the wind velocity to be used, (b) the quality of construction and installation likely to be present, and (c) how nearly the laboratory conditions are reproduced in the field. Since none of these considerations are susceptible of direct determination, it is necessary to make assumptions to cover all of them. Having done so, the final factor selected for use necessarily reflects the degree of accuracy possible in making the assumptions. There is reason to believe that in most cases the conditions surrounding the making of the assumptions are highly nebulous.

In the case of "air-change" factors, these come from sources unknown. Such factors have appeared in text and reference books for years. Attempts to discover their original source or the time of their original appearance have not been productive. While the values considered suitable for use have changed slightly from time to time with various authors not in agreement, the general range of these factors is from 1 to 3. In reasonably tightly constructed buildings or rooms where there is no undue exposure to avoid, the value is placed at 1, while in poorly constructed buildings or exposed rooms, the value is placed at 3.

Attempts to judge the relative accuracy and desirability of the two sets of factors come up against the difficulty that there is no definite criterion on which to judge. As a result the usual practice is to fall back on individual judgment or on evidence of reason or common sense as applied to each separate building to be estimated. In general, it can be concluded that:

1.—In the great majority of estimates, especially where double-hung wood sash is used without weather-stripping, it is doubtful if there is any choice between the two methods from the standpoint of accuracy. The same condition applies in the case of buildings constructed in the standard or traditional manner, where the ratio of glass surface (and window cracks) is not greater than ordinary practice; examples are residences, small stores, office buildings, etc.



Example—If the crack air leakage is 130 cu. ft. per lin. ft., what is the heat leakage when the air density is 0.080 and the temperature differential 80°? Project a vertical line from the 130 cu. ft. mark on the left-hand chart up to the 0.080 air density line. Then a horizontal line to the 80° temperature differential curve and a vertical line to the heat leakage scale. The leakage is found to be 193 B.t.u. per hr. per lin. ft.

Fig. 1. Chart for determining heat leakage for various air densities and temperature differentials.

2.—Where steel sash, especially the types which draw up tightly in closing, is used, or where there is weather-stripping, or where much glass is used in the sidewalls, there may be some increase in accuracy of the estimate if the "window leakage" method is used. Examples are buildings using "modern" materials or construction, including especially factory-type buildings.

With so little choice in relative accuracy, most people will make the selection of method on the basis of convenience or custom. Those who are in the habit of using the air-change method are likely to continue to use it, and are apparently rather well justified in doing so. Those who prefer the window-leakage computation, while they may be applying a method slightly more difficult, are not making any more serious error than are those who use the other one; in some cases they may even be getting a more accurate estimate.

We can now turn attention to the data in existence for applying each method and to the details of doing so. We will first consider the leakage method and then the air-change method.

In order to apply the window-leakage method it is necessary to have values for use in equation (2c). In applying this equation for winter estimates, it is doubtful if there is any justification for considering the air density d a variable, in view of the uncertainty about existing values of the leakage factor L. So also is it doubtful if there is any object in considering any values for t_i and t_o except 70° and 0° respectively. Using $d = 0.075$ and $(t_i - t_o) = 70$, the equation simplifies to

$$F = 1.26 \times L \times P$$

Values of L for various types of windows under conditions of wind velocity considered suitable for winter estimates in most localities are given in column 7 of Table 1. In column 8 the factor L is multiplied by 1.26. Therefore to find the Heat from Filtration Air in the usual winter estimate, it is necessary only to determine the number of feet of window perimeter exposed to wind pressure (using rule given in column 6 for each window) and multiply by the figure in column 8. This greatly simplifies the actual work necessary.

In finding the perimeter figures, however, there are several points to be taken into account. One is that all the windows are not used, only those exposed to the action of the wind. Since the wind does not blow from all directions at once, and can usually not do worse than strike a corner of the room or building, the following rules are suggested:

1.—Where room has windows on one side only, use them all in arriving at window perimeter.

2.—Where room has windows on two sides, consider only one and that the one having the greatest length of crack.

3.—In no case, even if the room or building is exposed on all four sides, use less than half the total crack.

There are occasional uses where the designer may feel justified in making calculations using some temperature difference other than 70 and some density other than 0.076. In such cases equation (2c) can be used directly making suitable substitution to fit the case. In addition, the chart (Fig. 1) has been prepared to reduce the amount of work in calculating such jobs. Solution of troublesome cases may be readily made from it.

For using the leakage method to compute the heat quality involved in filtration air in summer estimates,

there is little or nothing in the way of either procedure or data. It is well known that in most locations high wind velocities are not experienced at times when the summer load is at its peak. It is also well known that at low wind velocities the amount of air finding its way through window and door cracks is small. Moreover in most installations where summer cooling is practiced, there is an attempt to keep a slight pressure on the system to prevent air from filtering in. Also it is usually worth while for the sake of operating economy to give close attention to keeping windows and doors tightly closed and to provide wind protection for them. Then, too, the temperature difference maintained is usually in the order of 10° at the time of the peak losses instead of being 70° as is the case at the time of the winter peak. The result is that filtration air is greatly reduced in amount and the heat quantity resulting from it is commonly neglected in calculations. In this connection it is important to draw a clear distinction between filtration air and the outside air usually deliberately drawn into the system during summer operation. This outside air does involve an important amount of heat which must be allowed for. Fundamentally such air is not filtration air at all but is ventilation air and will be discussed in a later article.

We are now ready to consider the data and details of applying the air-change method. In order to do so it is necessary to have values to use in equation (2b). By reasoning similar to that just applied, $(t_i - t_o)$ can be taken as 70° for all except the most unusual cases and the air density d can be taken at 0.075 as before. Apply these values and equation (2b) becomes

$$F = 1.26 \times n \times v$$

Values for n—the number of air changes—are given in column 1 of Table 2. Column 2 gives values of 1.26 x n. In order to find room volumes quickly, the upper section of the chart (Fig. 2) can be used. Multiplying the volume by the figure obtained from column 2 of Table 2, then permits the heat quantity for winter estimates to be found with a minimum of computation.

Where more elaborate refinement is wanted, equa-

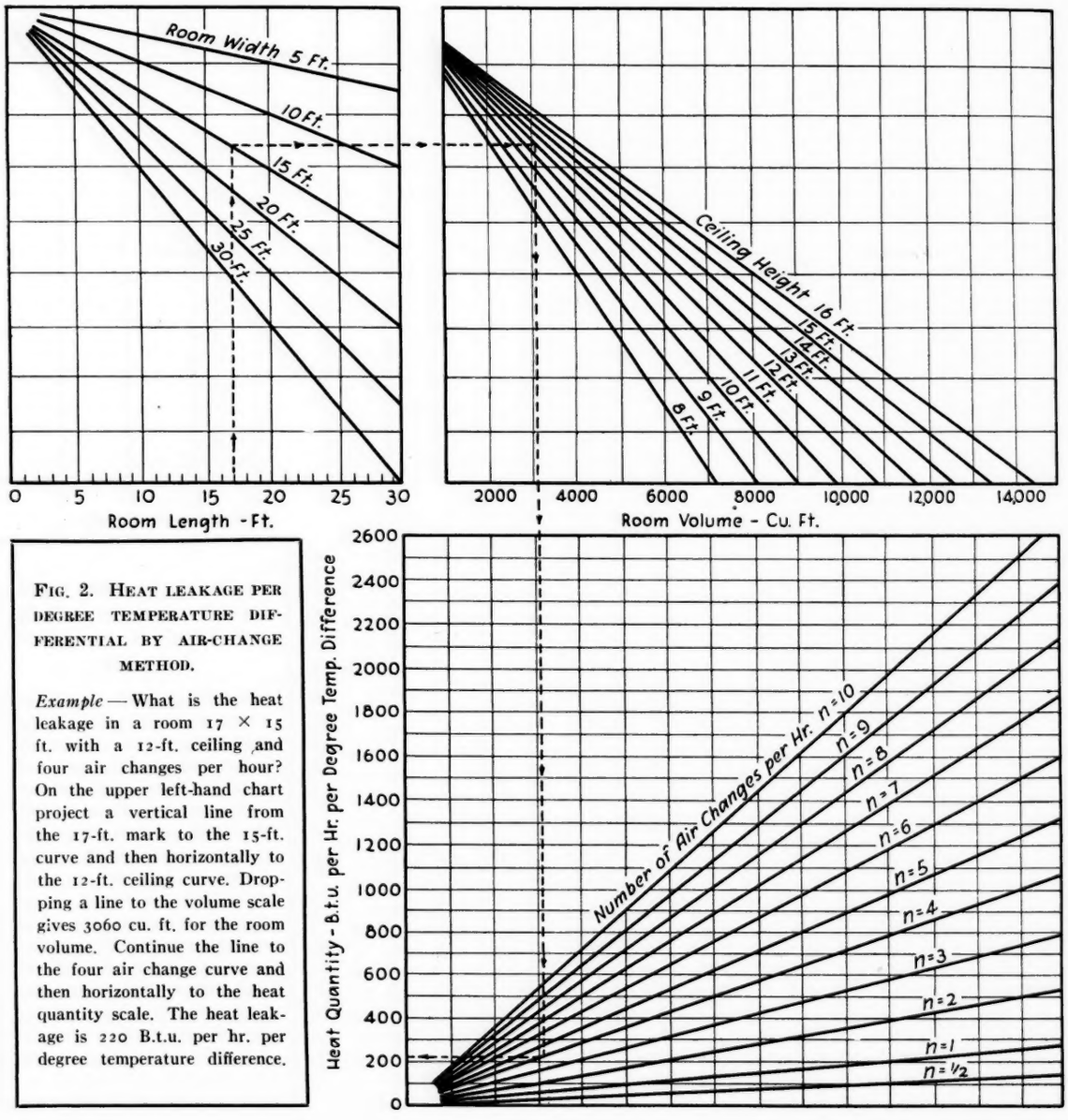


FIG. 2. HEAT LEAKAGE PER DEGREE TEMPERATURE DIFFERENTIAL BY AIR-CHANGE METHOD.

Example — What is the heat leakage in a room 17 × 15 ft. with a 12-ft. ceiling and four air changes per hour? On the upper left-hand chart project a vertical line from the 17-ft. mark to the 15-ft. curve and then horizontally to the 12-ft. ceiling curve. Dropping a line to the volume scale gives 3060 cu. ft. for the room volume. Continue the line to the four air change curve and then horizontally to the heat quantity scale. The heat leakage is 220 B.t.u. per hr. per degree temperature difference.

TABLE 2. FILTRATION OF AIR

Air changes (n in equation 2b) and heat changes in B.t.u. per hr. at 70° temperature difference

Room or Building Type	No. of Sides of Room or Building Having Windows	1 Number of Air Changes per Hr. (n)	2 n × 1.26 B.t.u. per Hr. per Cu. Ft. of Room Vol. at 70° Dif.
1. Office buildings; apartment houses ..... hotels; dormitories; multi-story ..... buildings in general	none	½	0.63
	one or two	¾ to 1½	0.94 to 1.89
	three or four	2	2.52
2. Entrance halls or vestibules ...	any	3	3.78
3. Industrial or factory buildings ..	any	2-3	2.52-3.78
4. Single, double, or duplex residences (all rooms)	any	1-1½	1.26-1.89
5. Public or monumental buildings	any	1½-3	1.89-3.78

Well installed weatherstripping may be credited with reducing air and heat quantity by 40 to 60% for purposes of winter estimating.

tion (2b) can be applied directly using values for C from the chart (Fig. 2) and for n from Table 2. The solution may also be made graphically from the chart (Fig. 2).

Statements made about filtration heat for summer estimates when using the leakage method apply equally to the air-change method. Seldom is an allowance for this quantity included in estimates of the maximum cooling load in summer.

With the methods of allowing for filtration now clear, we can give some consideration to the subject as a whole. It will be seen at once that no matter which method is used for actually making the computation, the values of constants and coefficients are open to serious question and assumption. In view of this it seems apparent that any attempts to refine or detail the calculation are superfluous and merely another of those operations which *seem* to give greater accuracy without really doing so.

It will be seen too that both methods are essentially alike, that neither has any inherent accuracy not possessed by the other, and that the choice is a matter of individual preference.

In recent years much attention has been given to improving the state of knowledge about filtration air quantities and the resulting heat exchanges. In spite of this the situation is still bad. The problem is so complicated that data are likely to be confused for some time to come. Probably the best fundamental is to use the existing information with the full understanding that it results in an estimate pure and simple, not a quantity having any degree of accuracy.

Another South African Gold Mine to be Air Conditioned

AIR conditioning has succeeded so well in one South African gold mine that another company has just ordered similar equipment, and the whole famous Rand district is expected to install refrigeration in order to keep on working the world's richest diggings, according to Thomas Midgley in a report to the American Chemical Society.

Mr. Midgley points out that the heat and humidity in the tunnels one and one-quarter to one and one-half miles below the surface have become almost unbearable. Faced with the possibility of being forced to abandon untold wealth, the mine owners are turning to American refrigerants to cool and dehumidify the tunnels. The Union of South Africa has cancelled tariffs on refrigerants to assist in the air conditioning problem, thus opening up a free field for American products.

Gold production in this district has increased until it now yields 53% of the world's output. The air in the main workings is almost completely saturated with moisture from water seepage and water introduced to keep down the dust of operation. The temperature of the various mines ranges from 82.5° to 100°, with the relative humidity almost 100%. Tests show that at 100° and 90% relative humidity a man can produce only about 30% as much work as at 85° and 80% humidity.

The Robinson Deep, the deepest mine in the world, was the first African mine to be air conditioned. Its shafts had been sunk to 8,500 ft., or more than one and one-half miles below the surface. Now the East Rand Proprietary Mine has contracted for air conditioning equipment. The shafts have reached a depth of 6,500 ft., and the temperature in the tunnels is 82.5°, with relative humidity 100%. The contract requires that the air be cooled to 73°, with 10% reduction of wet bulb temperature.

The air conditioning machinery will be installed in a room hewn out of solid rock 6,500 ft. below the surface. Water will be carried down from the 43rd level, some 350 ft. above the machinery room, and chilled by means of a condensing system. The air will be cooled by a system of sprays installed in a large air washer, and then will be blown into the workings by means of a fan. Ventilation and circulation will be secured by returning the air through a ventilation shaft.

Plans call for delivering air at the rate of 150,000 c.f.m. to the lower levels of the mine. To condense moisture in the air, 2,000 g.p.m. of water will be required, while 2,160 g.p.m. will be chilled for cooling purposes.

The first mine air-conditioning was in Brazil, in the Morro Velho Mine of the John Del Rey Mining Company. The refrigeration equipment was installed 5,800 ft. underground.

Heat Exchanger for Air Conditioning

A NEW type of heat exchanger for air and other gases has made its appearance in Europe. It may turn out to be very interesting for application here, since air conditioning in the United States involves refrigeration and is therefore more expensive than in Europe, where refrigeration is still little employed compared to its wide use over here. Since cold storage is the most expensive type of air conditioning, this apparatus should be most welcome in that field.

In principle, the heat exchanger is of the storage type, i.e., heat is stored up in material temporarily exposed to a stream of warmer air which is thus cooled by it, and it is later picked up again by a stream of colder air which is thus warmed. Such a type of heat exchanger has so far found use chiefly in industrial applications for taking heat out of furnace exhausts to be used again for preheating air for the combustion process. Especially when made of brick, these exchangers require a great deal of space, a considerable part of it for the somewhat complicated duct system needed for alternating the exhaust and the fresh air through either half of the apparatus.

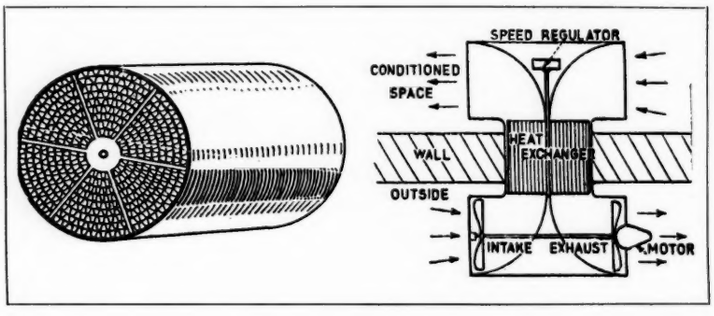


Fig. 1 (Left) End view of heat exchanger. Fig. 2 (Right) Plan view showing flow of cold and warm air.

Operation is Continuous

Previously all storage type exchangers have been intermittent in operation. This new device makes the process continuous. This is accomplished by departing from the former method of alternating the media through parts of the heat exchanger to alternating parts of the exchanger through the two media. This change of method in turn makes it possible to construct the storage elements in one piece, of cylindrical form, and rotating around an axis, which serves to render the process truly continuous, making the device actually a conveyor for heat.

Fig. 1 illustrates the conveyor proper, a drum open at both ends and filled with plenty of surface to come in contact with the air passing through it. With the intermittent method, the task obviously was to crowd a maximum of accessible capacity into the space allotted for storing the heat in order to have the largest possible storage effect per cycle. With this continuous method, there is no such urgent requirement because, as soon as the material has picked up its share of the heat, it is moved over from the warm stream into the cold stream. With the elements revolvable on an axle, this is very easy to effect, and what determines the capacity of the exchanger is no more the storage capacity of the material, but chiefly its amount of surface. Nothing is required of the material used but surface. Aluminum foil offers this and, in addition, it is not likely to be corroded by moisture. As may be seen from Fig. 1, it is arranged in corrugated form offering numerous passages for the air. In the direction of the axis, the foil is subdivided into sections in order to reduce conduction from the warm end to the cold. Such a conveyor is much lighter, smaller, and less expensive than other types of heat exchangers.

Fig. 2 shows how the conveyor is arranged in respect to the incoming and outgoing air. The illustration is to be understood as being a plan. The part of the casing inside the refrigerated space merely serves to separate and guide the counterflowing currents of air. At the right, the used air from the room enters the casing and is fed through the right half of the revolving part, the conveyor proper (Fig. 1), whence it is drawn by the exhaustor fan and discharged into the atmosphere, being blown away from the device. At the opposite end, fresh air is taken in and passed through the left hand side of the heat exchanger whence it is admitted into the conditioned room, or refrigerator. As the drum revolves, the warm, fresh air always strikes a cool surface to which it imparts heat which, with the foil, is carried over into the left half of the apparatus where it is exposed to the outgoing cold air, which is thus utilized to recool it for its recurrent task of cooling the incoming fresh air.

Obviously, the longer the drum, the faster the air can be blown through it, and the greater the difference in temperature permitted which represents the loss, the faster the drum can be revolved. In other words, the new device has the same characteristics as all other heat exchangers insofar as the larger the surface and the higher the temperature differential, the more heat can be exchanged.

Also Transfers Moisture

But it can do more than merely exchange heat. It can also exchange moisture. Those parts of the foil which have been cooled below the dew point of the warm air will collect moisture on their surface, will carry it over into the other flue together with the heat, and will also release both into the cold, dry air. Provided a sufficient amount of surface, the drum may be overspeeded. This results in lesser fluctuation of temperature of the foil, and reduces the amount of condensation to any desired degree.—*Siegfried Ruppricht in "Refrigerating Engineering."*

Railroads Push Conditioning of Cars

BOSTON — Over a hundred members and their friends attended the monthly meeting of the Air Conditioning Bureau of Boston May 22. Guest speakers were S. M. Anderson, railway car conditioning engineer for the B. F. Sturtevant Company, Boston; Kenneth Cartwright, assistant mechanical engineer of the New York, New Haven & Hartford railroad, and Lawrence Richardson, mechanical assistant to the vice-president and general manager, Boston & Maine Railroad. All spoke on the subject of railway car air conditioning.

Mr. Anderson said: "It has been variously estimated that between 5000 and 6000 cars will be equipped with air conditioning and in service this summer and it is interesting to note that the various systems of air conditioning for passenger cars in use today vary only in detail from the fundamental methods developed and patented in the earlier days.

"When we step into an air conditioned coach or chair car today, we are at once impressed by the abundance of cool, dehumidified air that is markedly apparent in summer, and a seeming uniformity of heat and air motion in winter. But alas, in many cars we are impressed both summer and winter alike by an entirely unnecessary and characteristic odor—a mixture of stale tobacco smoke and a general human efflorescence.

"In temperate sections of the country we generally adhere to the standard of the A.S.H.V.E., selecting for our worst conditions an outside temperature of 95° and a subsequent cooling capacity to produce an optimum temperature of 78° inside the car. We assume that on other summer days, optimum car temperature will follow.

"We know that they can be made to follow, but often do not because adjustment of the inside temperature is left to the judgment of the trainman, who is otherwise actively occupied, and his bodily metabolism is proceeding at a much higher rate than that of passengers. The 'trainman's fire is set too high' and he cannot judge accurately the sensibilities of his passengers.

"In the torrid southwest the problem is even less simple. If people living in the Arizona desert where temperatures of 110° or more are experienced were to plunge into an air conditioned car cooled to 78° the shock would be too great. Likewise an equally severe nervous shock would result to passengers on stepping from the car to the desert temperature. The only solution of this problem would seem to be use of segregated trains—one group conditioned for short and local travel and the other to take care of transcontinental passengers. As yet this has never been done, but specifications for cooling equipment on southwest trains now designate performances requiring sufficient cooling surface to make such a program possible."

Mr. Cartwright said: "The New Haven road started to air condition some of its cars in 1932, operating six such that year. In 1933 the total was 20, and last year the company had 159 air conditioned cars in service. This year, before the summer is over, the total will be over 400.

"In 1933, Class 1 railroads in the United States were operating a total of 648 air conditioned cars. Last year this had jumped to 2526 and for 1935 the total of railway and Pullman cars air conditioned is or will be 6075.

"In New England cooling the cars is not the whole story. It is more important in this area to air condition them in winter; the passengers get more benefit from air conditioning then. Cooling cars was the first step undertaken. But it was an economic problem. Cars in this climate need to be cooled but a few days in the year, and to make air conditioning economical, the cars must be in use practically 365 days in the year, so that we considered the matter of air conditioning heated cars in winter. The New Haven road was the first to attempt to heat a car through the air conditioning unit, and we found that we could do all the heating required for a car with the air conditioning unit until the outside temperature got down to 20°. Below that the side wall heaters cut in. However, air conditioning requires less heating steam than floor heat—about 30% less.

"Air conditioning a railway car is a much harder problem than air conditioning a house. There are 5000 cu. ft. of air to a car, over four times that in a dwelling, and the shape of the car complicates the problem. There are two methods in use—the bulkhead and the duct types. There is no question but the second type is better, but has higher cost. A unit suspended from the ceiling of the car at the centre with air discharged toward each end gives excellent results, however, with the bulkhead delivery. If a draft is felt at all it is the return air going to the recirculating unit. Twenty-five per cent outside air to 75% recirculated is as far as it is practicable to go without running up the refrigeration and therefore the cost.

"We found that in winter we could not run over 25% relative humidity in air conditioned cars with double windows; with single windows, not over 15%. When the passenger load of a car is complete, they were never operated. Humidity exuded by the bodies of the passengers was enough. The company finally removed them."

The speaker was followed by Mr. Richardson, who said that the average of days in New England when cooling is required in cars is only about 45, while in Maine it is only eight. Odors in a railway car are still a problem in air conditioning, particularly the smoking car.

The "Montrealer," a through train operated from Montreal across Vermont to Washington is iced through to Wilmington, Del., owing to conditions both in New York and Philadelphia, where icing cannot be done, platforms being too high and yard congestion too great.

The following table summarizes the railway air conditioning situation from reporting companies in 1934:

MANUFACTURER	ELECTRO-MECH.	DIRECT MECH.	ICE	STEAM EJECTOR	V-BELT
Airtrol	—	—	4	—	—
Am. Car and Foundry	—	—	5	—	—
Baldwin-Southwark	1	—	—	—	—
Frigidaire	66	—	8	—	1
General Electric—York	2	—	—	—	—
General Electric	1	—	—	—	—
Great Northern	—	—	1	—	—
Melcher	1	—	—	—	—
Pennsylvania	—	—	82	—	—
Pullman C. & M.	204	531	12	—	—
Pullman	—	—	512	—	—
Safety C. H. & L.	42	—	13	197	—
St. L. & S. F.	—	—	12	—	—
So. Pacific	—	—	13	—	—
Sturtevant	—	—	27	—	—
Trane	—	—	20	—	—
Wabash	—	—	14	—	—
Westinghouse	3	—	—	—	—
West.-Frigidaire	3	—	—	—	—
York	76	—	—	—	—
Young	—	—	—	—	—
Not Shown	—	—	23	—	—

ABSTRACTS of Current Papers, Books and Pamphlets

Classroom Odors with Reduced Outside Air Supply

There are many opinions as to the proper amount of outside air necessary for ventilation in classrooms. This has been reflected in the varying state laws pertaining to air supply. The amounts specified by law vary from 30 cu. ft. per occupant downward. It is a well known fact that to provide sufficient oxygen and to maintain a safe level of carbon dioxide in the room only a very small amount of air is necessary. Previous investigations have revealed that the discomfort of a poorly ventilated room is a result of overheating and odors. This study was made to determine the minimum amount of outside air that it is necessary to supply in order to prevent the odors from becoming objectionable.

Tests were made in three classrooms of a school in the suburbs of Pittsburgh. The rooms were occupied by the 7th, 8th, 9th, and 10th grade pupils from the better class section of the town. The amount of outside air was varied and a record was kept of the inside and outside dry bulb temperatures, humidities and carbon dioxide contents. The odor levels in the rooms were rated by a number of observers when entering from a corridor. The condition of the air in the room was rated on the following basis (1) good, (2) noticeable, (3) moderately objectionable, (4) objectionable.

The amount of air supply to the room was determined from the actual carbon dioxide and moisture content as it varied from the amount produced by the occupants. A number of tests indicated that the figure obtained by this method was reasonably accurate. It was found that in a classroom of conventional size, air leakage and the initial room air volume give an air change of from 1 to 1 1/2 per hr., or an air supply of from 3 to 5 c.f.m. per person.

The tests indicated that odors are little noticed by the occupants of a room, but are noticeable to one entering from a space with a lower odor intensity. It was also found that overheating gives a more pronounced sensation of discomfort than odors.

Odors are noticeable to one entering a room and looking for them when the air change drops below 11 c.f.m. per person but it is not until the air change falls below 9 c.f.m. per person that they become noticeable without looking for them. With an air change of approximately 7 c.f.m. per person, the odors become noticeably disagreeable.

[*"Classroom Odors with Reduced Outside Air Supply," by F. C. Houghten, H. H. Trimble, C. Gutberlet, and M. Lichtenfels. Paper to be presented at the 41st semi-annual meeting of the A.S.H.V.E., Toronto, Ont., June, 1935; approximately five thousand words; graphs.*]

BRIEF REVIEWS

A CATECHISM OF PENNSYLVANIA ANTHRACITE. This bulletin, made up of a number of questions and answers, has been prepared to furnish information regarding the production, distribution, and utilization of anthracite. Included is a list of rules for the firing of anthracite and a number of tables of anthracite production and other statistics. [*"The Formation and Characteristics of Pennsylvania Anthracite." Published by the Anthracite Institute, 19 Rector St., New York. Paper cover; 6 x 9 in.; 34 pages; price, 15c.*]

ARKANSAS FARM HOUSE CONDITIONS. A bulletin presenting the results of a study of housing conditions, including heating, conducted in Arkansas in the winter of 1934. [*"Arkansas Farm House Conditions and Needs," by Prof. Deane G. Carter. Published by the University of Arkansas, College of Agriculture, Agricultural Experiment Stations, Fayetteville, Ark. Bulletin 305; size 6 x 9 in.; 35 pages.*]

FIRE PROTECTION REGULATIONS FOR BLOWER AND EXHAUST SYSTEMS. A bulletin presenting the latest rules and regulations for the installation of blower and exhaust systems for heating and ventilating, removal of flammable vapors, and conveying of dust, stock, and refuse. A number of sketches illustrating fire protection devices for ducts are included. This standard was approved by the American Standards Association in January, 1935. [*"Regulations for the installation of Blower and Exhaust Systems." Published by the National Fire Protection Association, 60 Batterymarch St., Boston. Paper cover; 6 x 9 in.; 20 pages; ASA Z35-1935; price, 10c.*]

SMOKE REGULATION. Rules and regulations regarding the issuance of permits for fuel-burning equipment which have been adopted by the Department of Smoke Regulation in Hudson County, New Jersey. These rules are intended to be a guide for engineers, architects, contractors, and building owners. The object is to prevent the construction of future sources of smoke. [*"Rules and Regulations," issued by the Department of Smoke Regulations, County of Hudson, New Jersey. Paper-bound; 3¾ x 6¾ in.; 21 pages; enclose 3c postage with request for copy.*]

EXHAUST VENTILATION FOR CHEMICAL FUMES. The increasing use of volatile chemicals in industry has resulted in additional hazards to many workers. It has also necessitated the installation of exhaust systems to maintain the concentration of the fumes below the danger point. This paper presents a considerable amount of information relative to toxic properties of common gases and vapors and the design of hoods for controlling concentrations. [*"Prevention of Occupational Diseases Other Than Those That Are Caused by Toxic Dust," by R. Sayers and J. Dallavalle. Published in "Mechanical Engineering." April, 1935, pages 230-234.*]

BURNING RESIDUE FUEL OILS. Information on the burning of cracked-residue fuel oils. Contains a description of the difficulties encountered and how they are overcome. Course of procedure is outlined for converting plants that burn bunker "C" oil so that they can burn the new cracked-residue oil. [*Burning of Cracked-Residue Fuel Oils," by M. J. Hanlon. Published in "Mechanical Engineering," April, 1935, pages 241-243.*]

SUBSISTENCE HOMESTEADS—A general information bulletin issued by the Division of Subsistence Homesteads of the Department of the Interior, and which, in descriptive paragraphs, with photographs taken on subsistence homesteads projects, and by means of graphic charts, explains the activities and the aims of subsistence homesteading. The bulletin summarizes the program in a brief description of just what a subsistence homestead is. The bulletin describes the types of projects being undertaken by the Division; some 90% of the projects being of the industrial type in which part-time or seasonal workers are furnished with small homesteads on the edge of large cities or near the smaller industrial towns. [*"A Homestead and Hope"; illustrated; paper-bound; 24 pp. Published by the Department of Interior; free; Standard Size.*]

NEWS OF THE MONTH

209 A.C. Jobs Installed in North California in 1934

SAN FRANCISCO—Two hundred and nine air conditioning installations were istalled on the lines of the Pacific Gas & Electric Company during 1934, according to R. E. Fisher, vice-president in charge of public relations and sales of that utility. The Pacific Gas and Electric Company serves practically all of the cities in northern California.

The following table lists the installations made during 1934:

TYPE OF ESTABLISHMENT	No.	Hp.
Banks	3	15½
Baths	1	3
Ballrooms	1	1½
Bakeries	1	¼
Cafes and restaurants	9	31
Clubs	10	72
Creameries	1	1
Factories	1	40
Glass works	1	100
Hotels	2	10¾
Industrial process	1	20
Hothouse	1	½
Laboratory	1	2
Lodge	1	7
Mausoleum	1	2
Offices	8	23
Stores	17	37¼
Schools	1	7
Theaters	9	48
Undertakers	4	7
U. S. Government	2	7
Miscellaneous	129	71
Homes	4	9

Miscellaneous items include circulating fans installed principally on furnaces where an air filter is in use, and other small installations such as the circulation of cold water through pipes by small motor pumps and the distribution of the resulting cool air by small circulating fans. These installations range from 1/6 to 1/2 hp.

Many of the smaller installations itemized in the table have been made with the idea of increasing the use of air conditioning apparatus at a later period. In 1933, a funeral parlor installed a partial installation which proved so satisfactory that an additional unit was added in 1934. One man purchased a small unit for his home and in 1934 installed a similar one in his office. A club was so well pleased with its 1933 installation that an addition was made in 1934.

Daniels Promoted

BOSTON—Julius Daniels, president of the Air Conditioning Bureau of Boston, has been promoted by the Edison Electric Illuminating Company of Boston and appointed head of the utility's new promotion department, which is a combination of the former promotion and merchandising departments. J. J. Cadigan has been appointed assistant to Mr. Daniels.

Phila. Adds 149 A. C. Jobs

PHILADELPHIA—149 air conditioning systems were added to the lines of the Philadelphia Electric Company, according to H. H. Mather, promotional analysis section, service division, of that company. Residences led all other classes of buildings in number of installations whereas schools led in connected horsepower.

The detailed table follows:

TYPE OF ESTABLISHMENT	No.	Hp.
Apartments (Commercial Contracts)	6	4.0
Banks	2	180.0
Candy mfgs.	3	290.0
Chemists	1	7.0
Cigar mfgs.	1	12.0
Funeral parlors	2	15.2
Hospitals	2	17.0
Misc. commercial	5	320.8
Misc. industrial	4	58.0
Offices, board rooms, etc.	24	121.5
Printers, paper, etc.	3	10.0
Residences	37	56.0
Restaurants	16	226.4
Schools	21	391.0
Stores—retail	14	243.6
Stores—department	1	274.0
Storage—food	1	30.0
Studios	1	34.3
Textile	1	22.0
Theaters	4	143.0
TOTAL	149	2,455.8

Stores Air Condition

NEW YORK—Department stores here have become air conditioning conscious in a substantial way. Gimbel Bros., Wanamakers, and Abraham & Straus, have ordered the installation of comprehensive conditioning systems, work on which has begun.

Boston Adds 50 A.C. Jobs in '34

BOSTON—Fifty air conditioning installations for this city are reported for the year 1934. These totalled 2754½ hp. During first two months of the present year 128½ hp. have been added.

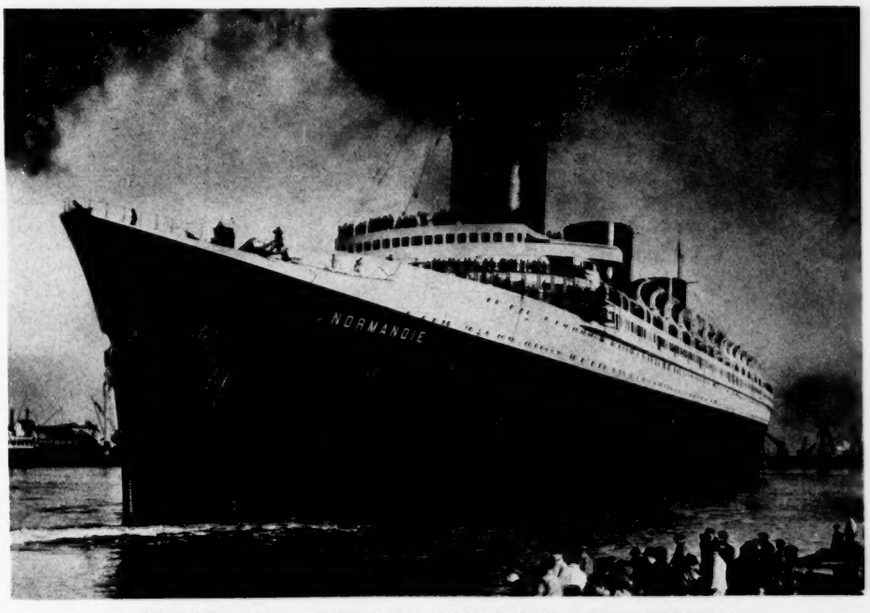
Prior to 1934 there were 4082 hp. connected, making a total up to March 1 of 7565½ hp. The detailed table of 1934 installations follows:

TYPE OF ESTABLISHMENT	No.	Hp.
Auditorium	1	28
Banks	3	20
Beauty parlors	3	50
Bars	4	46
Hotels	3	39½
Offices	9	33
Residences	9	19½
Restaurants	6	272
Stores	11	2246½
Theaters	1	—
TOTAL	50	2754½

Alabama Utility Promotes Fan Sales

BIRMINGHAM, ALA.—This year for the first time the Birmingham Electric Company is conducting a sales campaign on ventilating fans for the home. Sales so far have gone beyond expectations.

As a leader the utility is advertising a fan for only $9 cash or $9.95 on terms at $1.50 down and $1.50 a month. Under a promotional electric rate now in effect, the company claims further that the fan will only cost one cent a night to operate.



NEW FRENCH SHIP HAS AMERICAN CONDITIONING

New French liner "Normandie," which arrived in New York June 3, has elaborate air conditioning system in the dining room. The conditioned air is brought in through openings hidden by moulded art glass. There are 160 motor-driven ventilators on board the ship involving 25 miles of ductwork.

Refrigerating Engineers Meet, Discuss Rating Standards

DETROIT—With a total of 225 registered, the 22nd spring meeting of the A.S.R.E. at Hotel Statler, May 22-24, reached a record of attendance not approached in recent years.

At the opening session on Wednesday morning technical papers were presented by S. C. Bloom, vice-president of the society, who discussed "Some Trends in Air Conditioning"; F. O. Urban, General Electric, presented a new psychrometric chart and described its use. The chart is plotted with dry bulb temperatures as abscissae and weight of water vapor as ordinates. In general form it closely resembles the charts long in use but scales of total heat have been added. At the same meeting a paper "Window Glass as Insulation" was presented by C. D. Haven, Thermopane Co., Milwaukee.

Following a welcoming get-together luncheon those in attendance spent the afternoon either in playing golf or in visiting Detroit plants.

The principal entertainment feature of the meeting was the party given by "Electric Refrigeration News" at its new plant. The "News" had open house and welcomed all those in attendance at the meeting.

Two technical papers were on the program at the Thursday morning session presided over by George B. Bright. H. C. McPherson, Cincinnati, used the subject "Refrigerating Market Windows" to outline the various methods in use for refrigeration of display windows in retail stores where perishable products such as meat are exhibited. He showed the results which might be expected from each of 11 methods and set out the advantages and disadvantages of each.

Among the conclusions to which he came were that high humidities are necessary in such windows; that awnings should be used as well as ventilation, and double glass. Displays should be changed daily and hanging displays are considered impractical, except in cold weather.

"New Investigations in Absorption Refrigeration" was the subject of a paper by B. H. Jennings, Lehigh University. The author reviewed recent work in connection with absorption plants and reported on some tests made by himself on six-ton units. He pointed out that operating costs of an absorption system have been shown to be very low when fuel is cheap; that automatic controls simplify the operation of such plants, and that use of the heating boiler as a source of power for absorption refrigeration keeps down equipment costs.

The afternoon was occupied by a trip to Greenfield Village, while the annual dinner was held at Dearborn Inn in the evening.

The Friday morning session was devoted to a discussion of the development of standards and standard methods of rating. H. B. Pownall, engineering division, York Ice Machinery Corporation, presented a paper "Rational Development and Rating of Extended Air Surface." Mr. Pownall outlined the problem involved in designing such surfaces and illustrated test procedure and equipment used by him in arriving at data whereby the performance of a given design can be determined. He showed also that current theories on the subject of rating such surfaces are consistent and tenable. He showed that when the performance curves of a given surface are known it is not a particularly difficult process to get at the heat quantities which can be handled by a given amount of this surface. He emphasized, however, that in order to do this it was necessary to conduct accurate test work on each specific surface.

The remainder of the session was devoted to a consideration of the report of the committee on standards, and amendments, given by A. B. Stickney, engineer, Armour & Co., Chicago. The committee has been preparing this report for a considerable period and has drawn up rules and recommendations for rating of refrigerating systems or machines. This activity is a joint one between the society, the Refrigerating Machinery Association, and the Air Conditioning Manufacturers' Association. It is expected that the committee's work will eventually result in the establishment of a full set of standards.

Dallas Has 72 A.C. Systems

DALLAS—There are 72 air conditioning installations in this city connected to the lines of the Dallas Power & Light Company, according to E. R. Boruch, sales department of that utility. Of these 34 were added during 1934, 17 during 1933, and 21 in the years prior to 1933.

The detailed figures follow:

TYPE OF ESTABLISHMENT	PRIOR TO 1933		1933		1934		TOTAL	
	No.	HP.	No.	HP.	No.	HP.	No.	HP.
Hotels	1	290.5	1	2	1	203.5	1	496
Theaters	3	758.0					3	758.0
Restaurants	2	51.5	1	23	1	12.5	4	87
Large department stores	2	691.75					2	691.75
Other retail stores	4	247.25			2	28	6	275.25
Banks	1	392.50					1	392.50
Bank directors' rooms					2	4.2	2	4.2
Bank accounting offices	1	90					1	90
General offices			1	54			1	54
Office building					1	31.5	1	31.5
Small and private offices	2	9.25	4	30.6	10	42.05	16	81.90
Brokers' offices					1	28.25	1	28.25
Air conditioning companies	1	15	2	4.9	1	3.75	4	23.65
Funeral parlors			1	10			1	10.0
Utility store and auditorium	1	222.5					1	222.5
Residential	3	7.61	7	13.27	15	28.32	25	49.2
TOTAL	21	2775.86	17	137.77	34	382.07	72	3295.7

Toledo Adds 17 A.C. Jobs in '34

TOLEDO—There were 17 air conditioning installations made in this city during 1934 and connected to the lines of the Toledo Edison Company, according to F. L. Witsell of that company. These installations were as follows:

TYPE OF ESTABLISHMENT	No.	TONNAGE	HP.
Hotels	1	25	30
Mortuaries	2	13	13
Individual offices	6	6	9
Residences	8	8	12
TOTAL	17	52	64

A.C. in Akron

AKRON—According to the Akron Division of the Ohio Edison Company there were eight air conditioning installations made in this city during 1934. These are as follows:

	HP.	TONS
Shoe store	7½	7.1
Ladies' apparel	8¼	7½
Ladies' apparel	10	8.28
Restaurant	20	18
Candy manufacturing	5	4
Candy storage	½	½
Offices (2)	¼	Office units

A. C. Taught with Phonograph

CLEVELAND—A novel method of teaching air conditioning for correspondent students has been developed here by the Spencerian College, 3201 Euclid Avenue. It involves the use of phonograph records instead of printed lessons so that those taking the course will have the benefit of an instructor actually telling them what to do instead of reading it.

The course will be ready about June 15 and will cost $90 cash or $100 payable monthly. It is designed to cover the fundamentals of air conditioning theory and practice. It will also be possible to take the course at the college either during the day or evening. During the evening session approximately 10 months will be necessary to complete the work.

N.Y. City Gas Heat Rates to be Cut

NEW YORK — The Consolidated gas company system has filed with the Public Service Commission a schedule of reduced rates for gas used for house-heating purposes. The new rates are claimed to save the 3,202 house-heating customers about $311,000 a year.

At the offices of the company it was said that the reduction amounted to a 21% cut.

The new rates per month are as follows:

First 3000 cu. ft.	$1.15 per M
Next 6,000 cu. ft.	.75 per M
Next 6,000 cu. ft.	.60 per M
Over 15,000 cu. ft.	.50 per M

One of the conditions of the new rate is that gas must be used for the entire heating requirements of the customer. Another condition of the new rate is that the customer's bills must total at least $80 for the eight-month heating period from October to May, inclusive. The present radiation charge is completely abolished under the new rates.

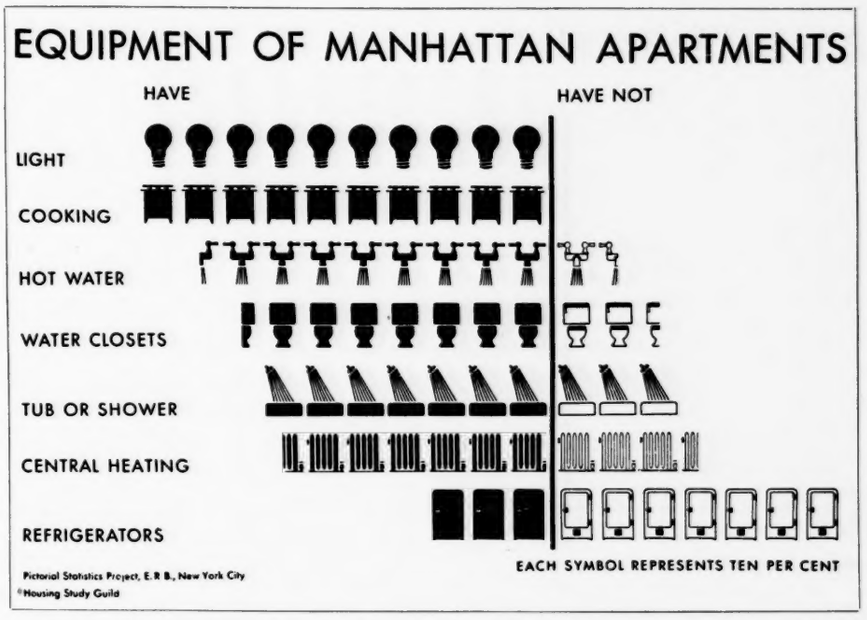
The effect of the new rates will be, according to the company, that customers will pay for the first 3,000 cu. ft, usually used for cooking and refrigeration, the same rates as at present, while the second block of 6,000 cu. ft. covers normal usage for heating water. All gas over that amount, used for house-heating, will cost the customer about 65 cents per 1000 cu. ft., the application said.

The application declared also that the company intended to try to place automatic heating of homes by gas on a competitive basis with other fuels.

Gage Standards in Tentative Form

NEW YORK—A proposed American Standard for accuracy and test methods for pressure and vacuum gages has recently been completed by subcommittee No. 4 of the sectional committee on the standardization of presssure and vacuum gages. This proposed standard is now being distributed to industry for criticism and comment. Copies are available on application. All communications should be addressed to C. B. LePage, assistant secretary, The American Society of Mechanical Engineers, 29 West 39th St., New York.

The standardization of accuracy and test methods for pressure and vacuum gages is one of the four subdivisions of the project assigned to the sectional committee on the standardization of pressure and vacuum gages, of which M. D. Engle is temporary chairman. This committee was organized under the procedure of the American Standards Association in 1930 with the A.S.M.E. as sponsor.



Distribution of mechanical equipment in Manhattan apartments on the basis of dwelling units.

O. B. Men Meet

BOSTON—Members of the Boston Oil Burner Associates held their 37th monthly dinner and meeting May 14 at the Engineers' Club. Guest speakers were George Fickett and Charles Soper of Minneapolis-Honeywell Regulator Company, and F. D. Bliss of General Electric Company.

150 A.C. Plants Installed in St. Louis Last Year

ST. LOUIS — One hundred and fifty air conditioning installations were made in St. Louis and connected to the lines of the Union Electric Light & Power Company during 1934, according to E. A. Freund, industrial development engineer of that utility. This makes a total of 321 air conditioning jobs on the lines of the utility up to January 1, 1935. A detailed list of the installations follows:

TYPE OF ESTABLISHMENT	PRIOR TO 1933		1933		1934		TOTAL	
	No.	Kw.	No.	Kw.	No.	Kw.	No.	Kw.
Residences	24	43.25	34	64.50	70	107.35	128	215.10
Offices	19	76.53	21	84.56	33	283.46	73	444.55
Retail stores	8	252.50	7	260.75	10	112.05	25	625.30
Sales and display rooms	6	61.00	4	9.50	7	26.36	17	96.86
Hotel dining rooms and coffee shops	8	488.13	2	60.00	3	52.00	13	600.13
Restaurants and bars	5	274.00	1	42.00	7	140.21	13	456.21
Miscellaneous	1	32.00	5	48.75	5	21.15	11	101.90
Industrial processes	5	669.60	4	91.50	1	9.00	10	770.10
Theaters	7	2,654.25	1	15.00	2	66.75	10	3,736.00
Bakeries	6	30.35	1	16.50			7	46.85
Undertakers	1	16.00			2	9.50	3	25.50
Banks					2	47.75	2	47.75
Beauty parlors					2	3.25	2	3.25
Office buildings (complete)	1	300.00			1	53.00	2	353.00
Broadcasting studios					2	14.13	2	14.13
Breweries					1	34.50	1	34.50
Printing plants					1	36.00	1	36.00
Service stations					1	4.00	1	4.00
TOTAL	91	4,897.61	80	693.06	150	1,020.46	321	6,611.13

Wallich Heads Detroit Group

DETROIT — About 40 members and guests attended the annual meeting of the Michigan chapter, A.S.H.V.E., May 15. The meeting was a combination golf tournament and business meeting. Officers nominated for the coming season and unanimously elected are: A. C. Wallich, president; R. K. Milward, vice-president; Frank Feely, treasurer and William F. Arnoldy, secretary.

The board of governors will consist of R. F. Connell, Edward Glanz, and A. P. Darlington.

Hansen Now Managing Engineer

NEWARK—Harold F. Hansen, formerly engineer for the National Commercial Title & Mortgage Guaranty Company of this city, has been made managing engineer of real estate for the New Jersey Title Guarantee & Trust Company of Jersey City.

WITH THE MANUFACTURERS • • • •

BELL & GOSSETT CO., Chicago, has purchased the stock, manufacturing equipment, patent rights, and good-will of the D & T Mfg. Co., St. Louis. Among the hot water specialties included in this sale are the Tank-in-Basement system, D & T water relief valve, self-filling air cushioned tank equipment, All-in-One hot water heating regulator, and other devices.

Operated for 25 years by J. M. Dougherty, the D & T Company is well known to the trade. The acquisition of this property rounds out the Bell & Gossett line. Sales and service will be handled through the Chicago Office.

THE BROWN INSTRUMENT CO., Philadelphia, and the MINNEAPOLIS-HONEYWELL REGULATOR CO., Minneapolis, have opened a joint office at 303—the 101 Marietta Street Building, Atlanta, Ga., to serve the southeast. Wesley R. Moore, for a number of years district manager of Brown Instrument Company, is manager in charge, with Leon L. Kuempel, sales engineer, Charles A. Kitzinger, service engineer, and J. A. Crawley, office manager.

DAIL STEEL PRODUCTS CO., Lansing, Mich., has appointed Joseph G. Stalb, as eastern district sales director, covering the territory from Washington north, including the eastern Atlantic seaboard. Mr. Stalb will be located at 155 East 44th St., New York.

THE ECONOMY EQUIPMENT CO. has moved its office and shop to 538 West Pershing Road, Chicago.

JONES & LAUGHLIN STEEL CORP., Pittsburgh, has appointed Walter H. Wiewel manager of sales, tubular products, to fill a vacancy caused by the death of F. D. Grunder.

Mr. Wiewel was employed by the Cambria Steel Company in its Cleveland office in 1910. In 1914 he became associated with the U. S. Steel Company at Canton, O., and in 1918 was appointed assistant general manager of sales of the successor company, United Alloy Steel Corporation. In 1925 he became manager of the New York office of the Standard Seamless Tube Company. Since 1932 he has been manager of sales for the Timken Steel & Tube Co., Canton.

MELCHIOR, ARMSTRONG, DESSAU CO., INC., New York, has leased offices at 400 East Lombard St., Baltimore, for a branch and warehouse. C. C. Storm, formerly promotion manager, will be in charge. Cecil Boling, previously engineer of the Boston branch, will be the Baltimore branch manager. The southeastern seaboard will be under the jurisdiction of the Baltimore branch. Its present southern salesmen—Messrs. Wright, Carlson, Travis, Booth, and Bosarge—who formerly worked out of the Philadelphia branch, will now operate from Baltimore.

OWENS-ILLINOIS GLASS CO., Toledo, has recently moved the sales department of its industrial materials division from Toledo to the Newark, Ohio, plant. This large plant is devoted entirely to the production of air filters, insulating wool, and other industrial glass products. Research and engineering as well as production are now carried on at the Newark plant, and the sales headquarters has been located there to insure close coordination of all activities.

Garland Lufkin

J. S. Irvine

Garland Lufkin, formerly manager of the Owens-Illinois factory at Bridgeton, N. J., is now in charge of the entire operation of the industrial materials division. J. S. Irvine continues as sales manager.

REPUBLIC STEEL CORP., Youngstown, Ohio, has removed its Philadelphia district sales office from the Fidelity-Philadelphia Trust Building, to the Broad Street Station Building, 1617 Pennsylvania Boulevard, effective May 18.

J. B. DeWolf continues in charge of the office as district sales manager, assisted by the present staff.

ROSS HEATER & MFG. CO., INC., Buffalo, N. Y., has moved its New York office to 40 West 40th Street.

SUNDSTRAND SALES CO., Rockford, Ill., has appointed W. A. Kemp as sales manager. Mr. Kemp was formerly sales manager of Silent Glow Oil Burner Company, and prior to that with Hardinge Oil Burner Company.

UNIT HEATER & COOLER CO., Wausau, Wis., has appointed Malina & Cooper, 416 West Erie St., Chicago, as its distributors in that territory. The junior partner in the firm is John R. Cooper, former sales manager of Thermal Units Manufacturing Company.

Behrer Acquires Nason

NEW YORK—Nason Mfg. Company of this city, which has rounded out 100 years as a manufacturer of steam traps and other heating specialities, terminated its century-old career June 1. The business has been sold to Behrer & Co., Mineola, L. I., and New York City, heating and plumbing wholesaler.

A.C. Manufacturers in Meeting

HOT SPRINGS, VA.—Over forty representatives of the leading manufacturers of air conditioning equipment met here May 23 in a session marked with optimism for a substantial increase in business volume in 1935.

The Air Conditioning Manufacturers' Association's annual meeting was the occasion for the gathering, presided over by P. A. McKittrick, Parks-Cramer Company. Studies in air conditioning engineering standardization which have been progressing for many months received particularly deep attention from these manufacturers' representatives.

New officers and directors of this leading air conditioning manufacturers' group were elected to guide the policies of ACMA in the coming year. The new board of directors elected consisted of: C. T. Morse, American Blower Company; Thornton Lewis, Carrier Engineering Corporation; H. C. Grubbs, De La Vergne Engine Company; W. F. Armstrong, Frigidaire Corporation; J. J. Donovan, General Electric Company; J. A. Harlan, Kelvinator Corporation; S. F. Myers, Westinghouse Electric & Manufacturing Company; Stuart E. Lauer, York Ice Machinery Corporation.

Mr. McKittrick was elected president and J. F. G. Miller, B. F. Sturtevant Company, was elected vice-president.

Status of R.R. A.C. in South

WASHINGTON—Railroads in the south have air conditioned a large number of diners and coaches with air conditioning. Included in these are a large number with Carrier-Safety systems, as follows:

Seven diners and 15 coaches for the Atlantic Coast Line; two coaches for the Central of Georgia; three diners and eight coaches for the Florida East Coast; 13 diners for the Louisville & Nashville; three coaches and two dining cars for the Nashville, Chattanooga & St. Louis; four coaches for the Norfolk and Western; two diners and three coaches for the Richmond, Fredericksburg & Potomac, and 23 diners for the Southern.

All air conditioned Pullmans in service on southern roads are equipped with compressor systems of either the electro-mechanical or direct-mechanical type developed by the Pullman Company. Pullman has also done two diners and three coaches for the Richmond, Fredericksburg & Potomac, and 55 cars for the Seaboard Air Line.

Westinghouse has furnished the equipment for eight combination passenger baggage cars for the Norfolk & Western, while Frigidaire has handled seven coaches for the Richmond, Fredericksburg & Potomac, and 11 dining cars and 18 coaches for the Norfolk & Western.

A.C. Aids Refrigerating Industry

HOT SPRINGS, VA.—A large group of manufacturers of refrigerating machinery met May 23 for the annual meeting of the Refrigerating Machinery Industry. In his report, Chairman of the Code Authority W. S. Shipley stated that while operation under the code had resulted in a better understanding among members of the industry and in a greater unity of purpose, that was the only item on the credit side of the code-operating ledger of the industry. On the other hand, Mr. Shipley stated:

"While it is gratifying to note that our industry as a whole showed a substantial increase in business in 1934 as compared with 1933, one should be frank in recognizing that the increase is not attributable to code operation but rather despite code operation. The Refrigerating Machinery Industry stands in a more fortunate position, so far as the national, industrial, and family life of our people is concerned, than practically any other durable goods industry. Refrigeration is a necessity of modern life. It is natural that sales of refrigerating machinery should show an upturn with any indication, however slight, of returning prosperity.

"The more general public acceptance of air conditioning has helped give factory production curves an upward trend and it has kept our industry from slipping as far into the red as we were in the dark days of 1932 and the almost-as-gloomy period of 1933. I believe that in air conditioning lies one of the most potent industrial factors for returning prosperity, certainly so far as the durable goods industries are concerned."

33 A.C. Systems for Houston in '34

HOUSTON — Thirty-three comfort air conditioning installations were connected to the lines of the Houston Lighting & Power Company of this city during 1934, according to E. F. Wilson of the air conditioning sales department of that utility. Eight of the installations were in offices and six in clothing stores. The detailed data are:

TYPE OF ESTABLISHMENT	No.	HP.	TONS
Building and loan	1	13	10
Beauty shop	1	16.5	10.5
Offices	8	52.8	30
Radio studio	1	5	4.3
Residences	5	46.1	26
Restaurants	2	17	15.6
Night clubs	1	64	48
Clothing stores	6	117.5	84.4
Shoe stores	3	25.5	18.3
25c to $1.00 stores	1	153	65
Jewelry stores	1	2	—
Miscellaneous stores	2	24.5	16
Theaters	1	112	70
TOTAL	33	648.9	398.1

Cincinnati Has 149 A.C. Plants

CINCINNATI—Seventy-four air conditioning jobs were added to the lines of the Union Gas & Electric Company of this city during 1934, and the outlook for 1935 is such that the company expects to add an air conditioning load equal to or greater than that reported in 1934, according to F. S. Dewey, general sales manager of that utility. The 74 jobs added during 1934 totalled 1319¾ hp. A summary of these installations follows:

TYPE OF ESTABLISHMENT	PRIOR TO 1933		1933		1934		TOTAL THROUGH 1934	
	No.	HP.	No.	HP.	No.	HP.	No.	HP.
Residences	8	14½	6	12½	25	35¼	39	62¼
Offices	8	19½	10	34½	25	127	43	181
Small stores	4	25½	1	20	10	221	15	266½
Large stores	2	405	—	—	2	640	4	1045
Restaurants	5	150	7	100½	5	59	17	309½
Theaters	6	1357½	3	280	3	177½	12	1815
Hospitals	2	6	2	20	1	19	5	45
Hotels (incl. restaurants)	3	1321	—	—	—	—	3	1321
Miscellaneous	5	377	3	18	3	41	11	436
TOTAL	43	3676	32	485½	74	1319¾	149	5481¼

Fleisher Addresses Buffalo Group

BUFFALO—The May dinner and meeting of the Western New York chapter, A.S.H.V.E., was held May 13 at the Tourraine Hotel with 65 present for dinner.

The speaker was Walter Fleisher, New York, consulting engineer, whose subject was research and its effect on the material requirements of air conditioning. He stressed in his preliminary remarks the definite psychological appeal of air conditioning to the public; how some manufacturers were wrongfully taking advantage of this condition, although these same manufacturers were continuing and intensifying the public interest. Mr. Fleisher outlined the summer cooling committee's activities and the diversity of opinion concerning the setting of summer cooling standards. In Mr. Fleisher's opinion, the Society's research program should be confined to determining fundamental facts.

In conclusion the speaker made some suggestions relative to possible revisions of the comfort chart. An interesting discussion between the speaker and L. A. Harding ensued.

Carrier Relates History of A.C.

NEWARK — The history of air conditioning was outlined recently to the Advertising Club of Newark at the Robert Treat Hotel by Willis H. Carrier, chairman of the board of the Carrier Engineering Corporation of this city.

Mr. Carrier told of his early experiments in Buffalo 33 years ago and of his first practical installation in 1907.

Committee on Exhaust Systems Appointed

NEW YORK — A special committee which will outline the essential points to be covered in a study of the fundamental engineering requirements for design and construction of exhaust systems has been appointed by the American Standards Association subcommittee on fundamental requirements of the sectional committee on safety code for exhaust systems. The subcommittee was assigned to submit a report which would give the sectional committee a clearer idea of the fundamental problems involved in the design and construction of exhaust systems.

The sectional committee found that its work depended not only on knowledge of engineering details of exhaust systems but also on knowledge of the effect on workers of the dust to be carried by the systems. The advisory committee on prevention of industrial diseases, which will be considered by the standards council at its next meeting, was therefore recommended to the safety code correlating committee by this sectional committee.

Members of the subcommittee on fundamental requirements include: S. E. Whiting, Liberty Mutual Insurance Company; Dr. R. R. Sayers, U. S. Public Health Service; J. C. Harding, consulting engineer; W. M. Graff, National Bureau of Casualty and Surety Underwriters; M. I. Dorfan, dust collecting division, Blaw-Knox Company; H N. Nichols, B. F. Sturtevant Company; Theodore Hatch, School of Public Health, Harvard University; Wm. L. Kepplinger, Carrier Engineering Corporation; G. E. Sanford, General Electric Company, and Dr. Leonard Greenburg, John B. Pierce Laboratory of Hygiene, Yale University.

District Heating Engineers Prepare for Twenty-Sixth Annual Convention in Philadelphia, 17 Manufacturers to Exhibit

PHILADELPHIA—The tentative program for the 26th annual convention of the N.D H.A., to be held here June 11-14, has been completed. Headquarters will be at the Hotel Bellevue-Stratford.

The golf committee has planned to hold a golf tournament at the Aronimink Country Club, June 12, where members will compete for the cup presented by the American District Steam Company, last year won by Warren Webster, Jr.

Seventeen manufacturers have arranged to exhibit in the hotel.

The tentative program follows:

JUNE 11

10:30 a.m.

Welcome—H. P. Liversidge, vice-pres and general manager, Philadelphia Electric Co.
President's Address—W. J. Baldwin, Jr., New York Steam Corp.
Report of Educational Committee—D. S. Boyden, chairman, Edison Electric Illuminating Co., Boston.
Report of Membership Committee—J. E. Hillemeyer, chairman, Union Electric Light & Power Co., St. Louis.
Report of Insurance Rates Committee—S. S. Sanford, chairman, Detroit Edison Co.
Report of Acting Secretary-Treasurer—Miss M. C. Stocker, Greenville, Ohio.
Appointment of Nominating Committee.

2:30 p.m.

Report of Rates of Regulations Committee—John M. Arthur, Jr., chairman, Kansas City Power & Light Co., Kansas City, Mo.
Report of Commercial Relations Committee—Leonard S. Phillips, chairman, New York Steam Corp., New York. Ownership of Equipment at Point of Delivery and Its Effect on Relations between Customer and Company, W. C. Kaber, Union Electric Light & Power Co.
New Developments in Temperature Control—Albert Fry, Illinois Maintenance Co., Chicago.
Study of a Standard Method of Calculation of Steam Usage—G. H. Tuttle, Detroit Edison Co.
The Effect of Intensive Utilization Work—F. Lee Rapson, Consolidated Gas Electric Light & Power Co., Baltimore.
Customer's Relations Affected by Metering Problems—W. W. Stevenson, Allegheny County Steam Heating Co., Pittsburgh.
The Present Methods of Office Records of Steam Uses—D. E. Washburn, Edison Electric Illuminating Co.
Steam Consumption in College Buildings—R. Y. Sigworth, supervisor of utilities, The Pennsylvania State College.

8:30 p.m.

Report of Hot Water Committee—F. L. Witsell, chairman, Toledo Edison Co.
Report of Operating Statistics Committee—A. D. Leach, chairman, Northwestern Electric Co., Portland, Ore.
Report of Manufacturers' Committee.

JUNE 12

9:30 a.m.

10-Min. Talk—Prof. H. W. Heff, Wharton School, University of Pennsylvania, Philadelphia.
Report of Research Committee—G. K. Saurwein, chairman, Harvard University.
Report of Sales Development Committee—R. J. J. Tennant, chairman, The Allegheny County Steam Heating Co.

JUNE 13

9:30 a.m.

10-Min. Talk—H. B. Bryans, vice-president in charge of operations, Philadelphia Electric Co.
Report of Steam Station Engineering Committee—J. R. McCausland, Jr., chairman, Philadelphia Electric Co.
Pease Anthony Gas Scrubber as Installed in the Heating Plant of the Edison Electric Illuminating Co.—N. S. Wade, operating engineer.
Design, Installation and Operation of the Cottrell Dust Collector as Installed at the Central Heating Plant in Washington, D. C.—F. P. Fairchild, power engineer, United Engineers and Constructors, Inc., Philadelphia.
Some Experiences in Cinder Elimination—John Dallas, mechanical engineer, Philadelphia Electric Co.
Zeolites—L. F. Collins, Detroit Edison Co.
The Care and Treatment of Boilers When Laid up for Extended Periods of Time—Harold Farmer, Philadelphia Electric Co.
Report of Distribution Committee—G. D. Winans, chairman, Detroit Edison Co.

JUNE 14

9:30 a.m.

10-Min. Talk—W. C. Wagner, superintendent of meter department, Philadelphia Electric Co.
Report of Meters and Accessories Committee—J. J. Schenk, chairman, Rochester Gas & Electric Corp.
Testing of Turbine Type Flow Meters—W. W. Stevenson, Allegheny County Steam Heating Co.
Method of Utilizing Condensate as Sealing Water for Air Line Vacuum Pumps—L. D. Gray, Union Electric Light & Power Co.
Hot Water Metering—F. L. Witsell, Toledo Edison Co.
Description of Testing Apparatus for Checking Condensation Meter Dials—R. H. Brown, Rochester Gas & Electric Corp.
Various Methods of Testing Condensation Meters—H. Warhanek, Milwaukee Electric Railway & Light Co.
Report of Bulletin Publication Committee.
Election of Officers.

Anthracite Laboratory Aids Industry

PRIMOS, PA.—Requests for all types of heating and fuel information are being received and answered at the rate of 2,160 a year by the Anthracite Institute Laboratory. Many of these involve active cooperation with manufacturers in improving their equipment.

In addition an average of 552 visitors are being received a year. Nearly all of these are specifically interested in some type of equipment and therefore have a definite purpose in visiting the laboratory.

Keep Buyers Cool as Well as Flowers

CHICAGO—One of the few new buildings to be erected recently on North Michigan Avenue is at Ontario Street. It is occupied in part by The George Wittbold Company's new air conditioned flower store.

Flowers need careful control of moisture and temperature in the air to preserve their freshness but in this case The Wittbold Company has extended air conditioning to the entire store.

According to P. D. Horgan, air conditioning editor of the *Chicago American*, a centrally controlled system was designed for the store. The equipment is located on a platform suspended from the ceiling in a room adjoining the sales space, with the exception of the refrigerating machine which is in the basement.

The cooling load required three tons of refrigeration. The system is designed to maintain the indoor temperature 15° below the outside in extreme weather, circulating 2,300 c.f.m. of air.

In the flower storage box in the basement as well as in the display case on the first floor the temperature and humidity which are best for flowers are maintained.

This equipment is designed for a temperature of 48° but 55° is about the usual temperature for flower storage. The relative humidity is kept at about 80%. Flowers must have more moisture than is found in the air in heated interiors during the cold weather. In the summer, flowers must be kept cool. In an air conditioned store where temperatures are never allowed to reach the high range, the proper handling of flowers is simplified by air conditioning.

Florists have one of the few places where air conditioning is needed for the goods that are sold as well as for the customers.

Ideal Stoker Forms Sales Outlet

DENVER—A separate sales organization to be known as the Ideal Stoker Sales Company was incorporated here recently to distribute the automatic stokers produced by the Ideal Stoker Manufacturing Company, located in Denver, the first company in this region to make stokers.

The incorporators are C. D. Moore, S. G. Moore, and W. D. McClain, and, in addition to these three, J. N. Shortley and Floyd N. Schumaker are on the board of directors. Authorized capital stock is 50,000 shares, par value $1. There are 25 employes in the new sales organization at present.

The units sell for from $245 for a small residence stoker to $1200 for an industrial unit, including complete installation and thermostatic control.

School Ventilation to Feature Technical Program of A.S.H.V.E. Summer Meeting

TORONTO—Members of the A.S.H.V.E. will assemble here June 17-19 as guests of the Ontario chapter, for the Society's semi-annual meeting. It is significant that the meaning of Toronto is "a place of meeting" and was so named by the Indians. Low rates of railroad fare are available to members of the society at a fare and one-third. Headquarters will be made at the Royal York Hotel, where technical sessions will be held each morning in the ballroom on the second floor.

The committee on arrangements in charge of the meeting will be: E. H. Gurney, chairman; L. L. Anthes, vice-chairman; M. F. Thomas, finance; E. R. Gauley, publicity; H B. Jenney and Mrs. E. H. Gurney, ladies; Thomas McDonald, banquet; W. P. Boddington, entertainment; M. W. Shears, transportation; H. H. Angus, reception; J. S. Paterson, registration, and H. R. Roth, secretary.

The principal events on the program follow:

JUNE 16

6:30 p.m.
Dinner and meeting of the Council.

JUNE 17

9 a.m.
Registration.

10 a.m.
Greeting.
Response by President Howatt.
Amendments to by-laws.
Characteristics of Registers and Grilles —J. H. Van Alsburg.
A Study of Classroom Ventilation:
Part 1—Classroom Odors with Reduced Outside Air Supply—F. C. Houghten, H. H. Trimble, Carl Gutberlet, M. F. Lichtenfels.
Part 2—Air Supply to Classrooms in Relation to Vent Flue Openings—F. C. Houghten, Carl Gutberlet, M. F. Lichtenfels.
Part 3—Classroom Drafts in Relation to Entering Air Stream Temperature —F. C. Houghten, H. H. Trimble, Carl Gutberlet, M. F. Lichtenfels.

1:30 p.m.
Handicap golf tournament for Research Cup.

3:30 p.m.
Sightseeing trip for ladies and members through Toronto.

7:30 p.m.
Informal dinner followed by dancing.

JUNE 18

9:30 a.m.
Heat Absorbing Glass Windows—W. W. Shaver.
An All-Electric Heating, Cooling and Air Conditioning System — Philip Sporn and D. W. McLenegan.
A Rational Heat Gain Method for the Determination of Air Conditioning Cooling Loads—F. H. Faust, F. O. Urban, L. Levine.

12:30 p.m.
Luncheon meeting of the committee on ventilation standards.

1:30 p.m.
Meeting of the Guide publication committee.

1:30 p.m.
Informal golf matches for members.

7:30 p.m.
Dinner-dance at the Royal York Hotel.

JUNE 19

9:30 a.m.
Oil-Burning Economy in Residences—D. F. Nelson.
The Dust Problem in Air Conditioning —F. B. Rowley.
Standards for Certified Air Conditioning—S. R. Lewis.

Rochester Installs 10 A.C. Jobs

ROCHESTER, N. Y.—Ten air conditioning installations were installed in this city during 1934, bringing the total now on the lines of the Rochester Gas and Electric Corporation up to 34. These are summarized in the table below.

The large capacity of the industrial installations is accounted for by four installations in photographic plants in this city totalling 21,448 hp.

Of the 10 installations made in 1934, all but one were commercial jobs.

The asterisk in the table indicates an ice installation.

TYPE OF ESTABLISHMENT	PRIOR TO 1933		1933		1934	
	No.	Hp.	No.	Hp	No.	Hp.
Industrial	10	22,135				
Office building	1	188				
Theater	4	1274				
Restaurant	1	*	2	115	2	21
Hotel					1	23
Stores					3	239
Radio studio					1	4
Offices	1	1	2	2	1	2
Library					1	265
Bank	1	11				
Residences	2	2			1	1
TOTAL	20	23,611	4	117	10	555

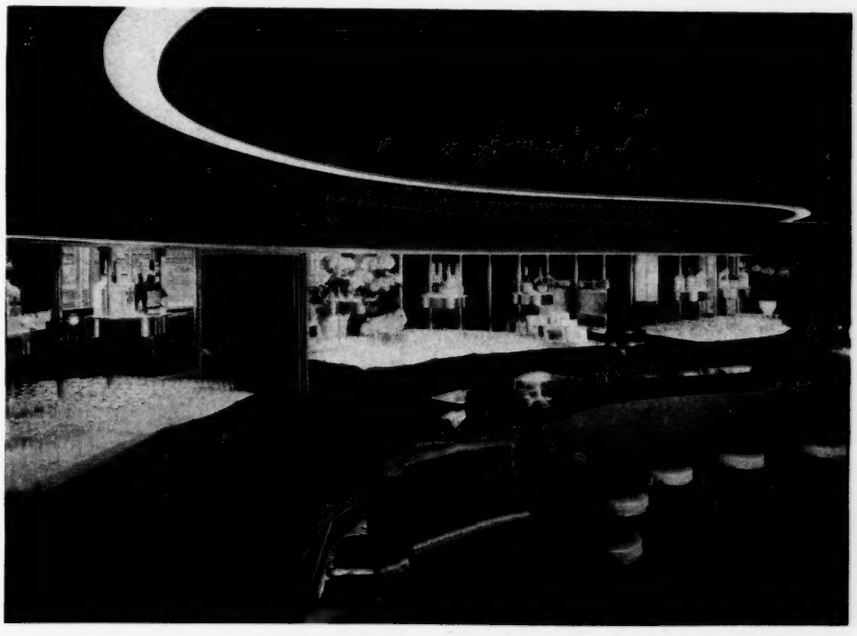
300 Attend N. Y. Meeting

NEW YORK—The annual dinner, entertainment and smoker of the New York Chapter of the American Society of Heating and Ventilating Engineers held May 20 at the Building Trades Club, 2 Park Avenue, was one of the most successful ever put on by the chapter. Over 300 attended.

The program included a mixed troupe of accordion serenaders under the direction of Joseph Rossi; music by Bill Gahagan and his Masters of Music; Gene Irving, magician, and two dancers.

The new officers of the chapter for the season of 1935-36 were introduced to the members. These are: W. W. Timmis, president; G. E. Olsen, vice-president; T. W. Reynolds, secretary, and W. W. Heebner, treasurer. The board of governors is as follows: H. W. Fiedler, A. F. Hinrichsen, and W. E. Heibel.

The affair was in charge of a committee headed by H. L. Alt, chairman. Other members were: J. A. Heller, M. G. Scheutz, and W. K. Walker.



Air conditioned bar in Hotel Morrison, Chicago. The ductwork for the air conditioning for this new cocktail lounge, opened May 11, was worked into the architectural scheme quite beautifully. The duct and grille are shown in the upper part of the picture.

Boston Department Store Sponsors Home Development Plan

BOSTON—One of the most important projects so far brought forward for building construction in this city is the home development plan announced by the Jordan Marsh Company, leading department store. It is important for two reasons. First, it marks the entrance of a department store into the home building field, and second because the plan contemplates inclusion in the houses to be erected of all the latest developments in construction and furnishings.

The first step in the Jordan Marsh plan is the prize contest for house designs, open to any architect, engineer, builder, or student of architecture and engineering. A first prize will be awarded for the winning design in each of four classes of $500, a second of $250, and honorable mention or consolation prizes of $75 each, to the number of four in each class. Competition in designs opened May 13 and will close at 5 p.m. June 25. Announcement of awards will be made five days later. The judges will be three professors of architecture, one or more real estate experts, one or more general contractors, two home economics experts, and one or more publishers.

A set of rules and regulations for those competing in the design contest states that all homes are to be designed for one family and to be located on lots of certain definite measurements for the different classes, and to have a one- or two-car garage according to the class of home entered. There are no restrictions as to style or materials of construction, except that they must be practical for the New England climate. A special department, in charge of Charles E. Coyne, as managing director, has been set up in the store's executive offices.

Class A houses are to cost between $5,000 and $7,500, exclusive of the land; Class B, between $7,500 and $10,000; Class C, $10,000 to $13,000; Class D, not more than $20,000. The Jordan Marsh Company will build, after the awards have been made and plans selected, one home to cost not more than $5,000, another at $6,000, two at $7,500, and one each at $10,000, $13,000, and $20,000.

While it is entirely up to the designers to plan what they please it is quite probable that they will consider oil heat and air conditioning. If so these will be installed as integral parts of the homes. The Jordan Marsh Company retails two makes of oil burners, either of which it could install.

"The purpose of this project," reports Edward R. Mitton, merchandising vice-president, "is to show how much one can build today for how little, and what proportion of expenditures the FHA will finance for one; to show how reasonably one can furnish or refurnish today and how low (properly budgeted) the cost is for so doing; to publicize properly the operations and items for which the FHA will help finance one, and how reasonably they will do so; to demonstrate how low the cost of refurnishing is today in proportion to what one receives (should one wish to refurnish).

Edward R. Mitton, merchandising vice-president, Jordan Marsh Co., Boston.

"We started working on the Jordan Marsh Company home development plan as long ago as last November, and it gradually took form until now we are ready to announce it to the public."

The houses will be built in the vicinity of Boston, in good neighborhoods that are easy of access from the city and within reasonable fare limits. Apparently lots for the purpose have already been secured (although this has not been stated) as construction is to start immediately after the awards are announced.

30 A.C. Jobs in Brooklyn in '34

BROOKLYN — Thirty air conditioning systems were installed on the lines of the Brooklyn Edison Company, Inc., during 1934, according to Charles L. Harold, manager of the commercial engineering bureau. Summary of the installations on this utility's lines follows:

TYPE OF ESTABLISHMENT	PRIOR TO 1933		1933		1934	
	No.	Kw.	No.	Kw.	No.	Kw.
Banks	2	445	—	—		
Bake shops	—	—	1	3		
Confectionery stores	—	—	1	30	1	45
Doctors' offices	—	—	—	—	4	7.5
Funeral chapels	1	3				
Hospitals					1	.5
Offices	1	1	3	4	6	61.5
Restaurants	—	—	2	34	3	95
Stores	4	75	—	—	7	147
Theaters	15	2790	4*	135	8*	204
TOTAL	23	3314	11	206	30	560.5

*Well supplies cold water for cooling.

Chicago PWA Housing Project Suspended

CHICAGO—Architects working on plans for the proposed $12,500,000 West Side slum clearance and low-rent housing project were ordered on May 4 by Public Works Administrator Harold L. Ickes to suspend all activities.

Organized attempts to secure from the Federal Government prices for land in the project site many times in excess of fair cash value set by current appraisals and beyond the prices which would permit low-rent housing; attempts of mortgage companies in effect to use the Government as a collection agency; deliberate attempts to speculate in mortgages, and solicitation of property owners to sign contracts for legal representation to obtain prices in excess of Government offers on contingency fees have been uncovered in the area.

As a result, acting on the recommendation of Col. Horatio B. Hackett, director of the Housing Division, Administrator Ickes has authorized abandonment of a substantial portion of the 165-acre West Side project. Administrator Ickes has authorized the Housing Division to continue the project on a greatly reduced scale if some smaller contiguous area within the site can be purchased at a fair market price—otherwise the entire $12,500,000 project which was to replace a huge amount of substandard housing in Chicago will be abandoned.

60-Year-Old Radiators May Go to Japan

NEW YORK—The Pocantico, an ancient apartment house which has stood more than sixty years at the northeast corner of Broadway and 53rd Street, is being razed to make way for a two-story business building which will cost $90,000 to build and be ready for tenants about August 1.

A wagon load of radiators of a type which has not been installed in this city in forty years was taken to New Jersey, perhaps to be sold to the Japanese government, which is buying up metal scrap. The radiators consisted of a series of 12 tubes 3 ft. long, rising from a circular base, and the tubes were not joined at the top.

Smoke Abatement Profitable to N. J. Taxpayers

JERSEY CITY—Continued progress in the work of smoke elimination in Hudson County, N. J., is shown by the annual report for 1934 of the Department of Smoke Regulation of the Board of Health and Vital Statistics.

William G. Christy is the smoke abatement engineer and John L. Hodges is deputy smoke abatement engineer.

"While we are still in the midst of one of the worst depressions, more plant improvements were made in 1934 than in any year since this department started," the report states. "More than 2,300 permits were issued for new fuel-burning equipment. Particularly noticeable is the increase in the installation of steam-air jets, stokers, and oil burners."

All industrial, commercial, and heating plants are included in the work of the department. Last year 20,911 stationary plant observations were made and 198 violations noted, giving a percentage of violations of 0.95%. In 1933 the percentage of violations was 2.32 and in 1931 it was 9.15%.

The department made 3,508 observations of floating equipment and noted 43 violations, resulting in a percentage of violations of 1.23 for the year. In 1933 this percentage was 1.84 and in 1931 it was 17.10%.

"The fuel users of Hudson County," according to the report, "saved $223,000 last year on account of better combustion due to elimination of smoke. Similar estimates for the three previous years show accumulative savings of $531,000. This makes a total of $754,000 for the four years since the Hudson County smoke ordinance was adopted. The estimated saving of $223,000 for 1934 is almost eight times our budget of $28,000. In other words, taxpayers of Hudson County are receiving returns of 700% a year on their investment in smoke abatement."

7 A.C. Plants for Hartford in '34

HARTFORD — Seven air conditioning installations were made in this city during 1934, according to E. D. P. Gross, power engineer, Hartford Electric Light Company. This makes a total of 17 installations in this city.

These installations are summarized as follows:

Type of Establishment	Prior to 1934		1934	
	No.	Hp.	No.	Hp.
Industrial	3	127	1	10
Offices	4	93½	1	80
Residential	—	—	1	2
Restaurants	2	16½	—	—
Stores	—	—	4	441½
Theater	1	167½	—	—
Total	10	404½	7	533½

80 A.C. Homes for Flushing

NEW YORK—Eighty homes, designed to include year-round air conditioning at prices within the reach of families of average means, are planned for construction during the next six months by Friendship Homes, Inc., at Flushing, L. I.

The six-room, two-story houses with complete equipment for year-round cooling, heating, ventilating, and conditioning are priced under $6,000. Six of the houses are now under construction and the first to have complete air conditioning equipment installed was opened for public inspection Mav 25.

The Chrysler Airtemp units used in providing air conditioning utilize the domestic water system as a medium of heat transfer, eliminating the need for a separate furnace. The hot water heater, fired by an oil burner, together with a compressor for cooling water, is located in the basement. An airtemp conditioning unit is concealed in a special compartment on the first floor of the house.

The heater provides hot water for the coils of the unit when the house is to be heated in winter and serves as the source of the domestic hot water supply throughout the year. The compressor chills water for the unit in summer when the house is to be cooled and conditioned.

The changeover from heating to cooling can be made by turning a valve. This cuts off the heating or cooling without interfering with the water supply. Humidification or dehumidification is controlled by a separate valve.

Obahr Forms A.C. Firm

NEWARK—The Northern Air Conditioning Corporation, formed to deal in air conditioning equipment, has been granted a state charter. Theodore W. Obahr is the registered agent.

Queens Has 40 A.C. Systems

LONG ISLAND CITY, N. Y. — Twelve air conditioning installations were made in the borough of Queens during 1934, according to L. J. Montgomery, general sales manager, New York and Queens Electric Light and Power Company. These figures do not include those made on the Rockaway Peninsula.

A table showing installations made during 1934 and prior to that follows:

Type of Establishment	Prior to 1934		1934		Total	
	No.	Tons	No.	Tons	No.	Tons
Industrial	6	817	4	27½	10	844½
Offices	3	5	1	2	4	7
Restaurants	1	13	—	—	1	13
Stores	2	9	—	—	2	9
Theaters	13	1490	2†	92	15†	1582
Residential	3	6	5	9¼	8	15¼
Total	28	2340	12	130¾	40	2470¾

†Includes a well-water cooling system.

National Radiator Forms Financing Subsidiary

JOHNSTOWN, PA.—The increasing volume of modernization business financed under the company's protective payment plan has led the National Radiator Corporation to create a subsidiary company to handle such financing. The new organization, known as the Housing Finance Corporation, operates under the Federal insured loan plan. Its first official act was the liberalizing of payment terms by a special summer offer, permitting property owners to have plants installed now, with the first monthly payment deferred to as late as September 30.

Metropolitan to Install Cooling at $100,000

NEW YORK — An appropriation, said to be about $100,000, for air cooling and improving the ventilation of the Metropolitan Opera House has been made by the board of directors of the Metropolitan Opera and Real Estate Company.

The statement of the directors pointed out that "while the work to be done does not propose a year-round air conditioning system, it is believed that the former lack of ventilation at the Opera House, which has been the cause of criticism and complaint on the part of many of the patrons of opera, will be thoroughly corrected."

The new improvement, which will make the house comfortable during the early summer, will be undertaken in a few days and will be finished before the opening of the season December 16.

Concerning this the directors said:

"The subject of fully air conditioning the Opera House was given careful study by the directors, who had the assistance and cooperation of several engineering experts. The importance of impairing in no way the acoustic properties of the auditorium was one of the factors which had to be kept in mind in guiding the directors.

"Perhaps no large opera house in the world has such excellent acoustic qualities as the Metropolitan, and it would be unfortunate if a too complete modernization of the building were undertaken at the expense of conditions so satisfactory to artists and patrons alike."

Free A. C. School in Denver

DENVER—A course to train air conditioning salesmen and service men was started recently at the public opportunity school here. It is believed to be one of the most unusual courses on that subject offered anywhere, since it is open and free to the public and there are no age limitations.

The course was suggested by and is under the direction of Philip P. Self, who received an award recently from the A.S.M.E. for his research in air conditioning at the Colorado Agricultural College.

The course this spring, Mr. Self said, is largely an experiment to determine interest in air conditioning as a vocation. The classes are held one hour every day, with an average attendance of twelve. Use of psychrometric charts and an elementary study of heating and ventilating problems compose the spring curriculum.

Seventy-five persons have expressed a desire to join the class if night sessions are held, so that the school authorities have authorized the preparation of a thorough course, with both day and night classes, to begin next fall. One large company actively promoting air conditioning has agreed to have its entire sales staff of 50 men take the course.

Burner Code for Canada

OTTAWA, ONT. — The National Research Council has announced that its oil burner laboratory is now engaged in experimental work on various types of oil burners with a view to drafting an oil burner code for adoption within the oil burner industry in Canada. Jurisdiction will be a purely provincial matter, each province having the liberty of preparing its own legislation.

27 A.C. Jobs Added by Illinois Utility

CHICAGO — Twenty-seven air conditioning systems were added to the lines of the Public Service Company of Northern Illinois, according to C. W. Bradley, vice-president of that utility.

The horsepower per installation of jobs made prior to 1932 was 149. During 1932 the figure dropped to 46, and to 17 in 1933. In 1934 there were only 14 hp. per installation.

A summary of the installations follows:

TYPE OF ESTABLISHMENT	PRIOR TO 1934		1934		TOTAL	
	NO.	HP.	NO.	HP.	NO.	HP.
Residences	21	86	11	21½	32	107½
Offices	1	1½	4	194	5	195½
Restaurants	5	98½	1	3½	6	102
Stores	14	242½	7	53	21	295½
Mortuaries	1	3½	1	5	2	8½
Theaters	24	1936	3	100	27	2036
Industrial	6	1815	—	—	6	1815
TOTAL	72	4184	27	376	99	4560

A.C. Popular in Indianapolis

INDIANAPOLIS—Twenty air conditioning installations of less than 50 hp. capacity were added to the lines of the Indianapolis Power & Light Company of that city during the eight months from January 1 to September 1, 1934. The data are summarized below.

In addition there was an air conditioning installation totalling 200 tons and 285 hp., made in a department store which was an addition to a 1929 installation of 250 tons with a connected load of 370 hp.

The information is available through the courtesy of J. B. Bailey, commercial manager of the utility.

TYPE OF ESTABLISHMENT	NO.	TONS	TOTAL HP.
Restaurants	3	34	40¼
Retail stores and shops	2	13	24
Funeral homes	1	6	7
Beauty and barber shops	0	0	0
Chain stores (any type)	0	0	0
Jewelry	1	2	3⅛
Industrial	2	1¼	1¾
Residences	9	19¾	25¼
Individual offices	2	1¾	3⅛
TOTAL	20	77⅜	104½

Correspondence Courses in A.C.

BOSTON — A course in heating and ventilating in two parts, open to those who have completed courses in applied mathematics and a course in drawing for mechanics is now being conducted by the University Extension Division of the Massachusetts Department of Education. The lectures are given by J. R. Allen and the instructor is G. A. Graff, of the C. J. Fox Engineering Company. There are a number of persons living outside the state who are taking the course, paying the higher fee of $10 for the two parts, where Massachusetts residents pay $6.

The course covers calculations of heat losses from buildings, types of radiators, rating of boilers, care and operation of boilers, piping systems, hot water piping, ventilation, humidity, warm-air and steam furnaces, fan systems, central heating systems, steamfitting, testing systems, plans, specifications, and estimating, with 10 assignments in each part.

Still more attention is being paid to air conditioning, and a course is now under way in air conditioning for large buildings, given by J. E. York, of the Stone & Webster Engineering Corporation, with R. U. Fittz of Tufts College as instructor.

Demands Hearing on Housing Bill

NEW YORK — An immediate hearing on the Wagner-Wood federal public housing bill was demanded in a resolution passed at the fourth annual dinner of the National Public Housing Conference here May 7. Senator Wagner spoke to the annual dinner from Washington stating that the bill he has introduced in Congress for a permanent public housing division in the Department of the Interior was based on the need for low-rental housing on a national scale, as revealed by the Real Property Inventory.

Contractors Condemn Force Account Work

(Concluded from page 48)

"Whereas, The passage of the Works Relief Bill and pending Social Security Bill vitally affect this condition and the other recommendations and exceptions as outlined by John H. Zink before this convention assembled; now, therefore, be it

"Resolved, That this Convention does hereby record its approval of Mr. Zink's letter of objections to the Senate Finance Committee on the Pending Social Security Act and, also, his report on recommendations to the National Government under the $4,800,000,000 Works Relief Bill and authorize him to continue his fight for the proper recognition of the Contracting Industry under the provisions of this Bill and the elimination of Government and its agency competition."

The nominating committee reported that following considerable persuasion they had secured the consent of the present officers to continue to serve for another year, although this meant considerable personal sacrifice on their part. Accordingly J. Lawrence DeNeille was placed in nomination for president; John H. Zink, vice-president, and Maurice J. Chagnard, treasurer. Of the five members of the Board of Trustees whose offices expired at the convention, Curtiss N. Gilley and Walter Klie were not renominated and their places were taken by A. C. Rodoni, San Francisco, and Frank E. Kise, Cincinnati. Following election the new officers and directors were installed in office and the convention closed.

129 A.C. Jobs in Minneapolis, 52 in St. Paul; 103 Are Well Water Systems

MINNEAPOLIS — There were 26 air conditioning installations added to the lines of the Northern States Power Company in this city during 1934, and 37 installations made in St. Paul during the same period, according to H. E. Young, vice-president in charge of sales of that utility. The figures do not include installations in outlying districts of the Northern States Power Company.

Tables summarizing these installations follow.

The columns headed "Water" refer to installations using heated well water for cooling through spaces for counter flow fin type coils.

Oil Prices

NEW YORK—Effective May 8 the tank car price of No. 1 heating oil at the New York terminal was reduced from 5¼ cents to 5 cents per gal. by Standard Oil.

A.C. for Mellon Bank

CHICAGO—M. G. Harbula and Associates have been retained to air condition the Mellon National Bank at Pittsburgh. Major Harbula, who plans to make this an outstanding bank job, and some of his staff were in Pittsburgh for several weeks recently making preliminary surveys preparatory to the actual work of designing the air conditioning system which is intended to serve the entire building, including all rooms and departments in the basement.

AIR CONDITIONING INSTALLATIONS IN ST. PAUL

Type of Establishment	Prior to 1934						1934						Total					
	Mech. Ref.		Water		Total		Mech. Ref.		Water		Total		Mech. Ref.		Water		Total	
	No.	Hp.	No.	Hp.	No.	Hp.	No.	Hp.	No.	Hp.	No.	Hp.	No.	Hp.	No.	Hp.	No.	Hp.
Restaurants	1	10	1	10	2	20	—	—	—	—	—	—	1	10	1	10	2	20
Theaters	—	—	6	145	6	145	—	—	4	125	4	125	—	—	10	270	10	270
Stores	1	2	—	—	1	2	1	20	—	—	1	20	2	22	—	—	2	22
Offices	2	4	—	—	2	4	10	27	1	1	11	28	12	31	1	1	13	32
Hotels	—	—	2	65	2	65	—	—	—	—	—	—	—	—	2	65	2	65
Public buildings	—	—	1	30	1	30	—	—	—	—	—	—	—	—	1	30	1	30
Banks	—	—	1	50	1	50	—	—	—	—	—	—	—	—	1	50	1	50
Residences	—	—	—	—	—	—	21	2	—	—	21	2	21	2	—	—	21	2
Total	4	16	11	300	15	316	32	49	5	126	37	175	36	65	16	426	52	491

AIR CONDITIONING INSTALLATIONS IN MINNEAPOLIS

Type of Establishment	Prior to 1934						1934						Total					
	Mech. Ref.		Water		Total		Mech. Ref.		Water		Total		Mech. Ref.		Water		Total	
	No.	Hp.	No.	Hp.	No.	Hp.	No.	Hp.	No.	Hp.	No.	Hp.	No.	Hp.	No.	Hp.	No.	Hp.
Restaurants	8	43	5	95	13	138	—	—	4	59	4	59	8	43	9	154	17	197
Theaters	—	—	21	350	21	350	—	—	3	33	3	33	—	—	24	383	24	383
Stores	12	28	7	138	19	166	3	53	2	52	5	105	15	81	9	190	24	271
Offices	1	4	—	—	1	4	4	4	4	1	8	5	5	8	4	1	9	9
Beauty parlors	1	2	—	—	1	2	—	—	—	—	—	—	1	2	—	—	1	2
Mortuaries	—	—	3	10	3	10	—	—	1	6	1	6	—	—	4	16	4	16
Hotels	—	—	1	35	1	35	—	—	1	2	1	2	—	—	2	37	2	37
Industrial	—	—	—	—	—	—	1	10	—	—	1	10	1	10	—	—	1	10
Churches	—	—	1	10	1	10	—	—	—	—	—	—	—	—	1	10	1	10
Public buildings	—	—	—	—	—	—	1	19	—	—	1	19	1	19	—	—	1	19
Residences	9	10	34	9	43	19	2	5	—	—	2	5	11	15	34	9	45	24
Total	31	87	72	647	103	734	11	91	15	153	26	244	42	178	87	800	129	978

New A.C. Dealer

MOUNT VERNON, N. Y.—The Air Conditioning, Heating & Refrigerating Company, Inc., has been chartered here to engage in a heating and air conditioning business. Incorporators are A. I. Polhamus, New York; W. Hugh Dailey and Doris Doyle, both of Mount Vernon.

A.C. for Church

CHICAGO—The new edifice of the Roman Catholic church of St. Luke in River Forest is expected to be completed for Easter, 1936. The church, which will cost more than $300,000 and will seat 800, is expected to have air conditioning.

Requests Catalogs

BALTIMORE — The Mechanical Engineering Construction & Equipment Company, Inc., of this city, which recently opened an air conditioning department is interested in receiving catalogs on air conditioning and refrigeration.

COMING EVENTS

JUNE 11-13, 1935. *Short Course in Coal Utilization to be held at the College of Engineering, University of Illinois, Urbana, Ill.*

JUNE 11-14, 1935. *Annual Convention of the National District Heating Association, Bellevue-Stratford Hotel, Philadelphia, Pa.*

JUNE 17-19, 1935. *Semi-Annual Meeting of the American Society of Heating and Ventilating Engineers, Royal York Hotel, Toronto, Canada.*

JUNE 19-21, 1935. *Semi-Annual Meeting of the American Society of Mechanical Engineers, Cincinnati, Ohio.*

JUNE 25-27, 1935. *Fifty-Third Annual Convention of the National Association of Master Plumbers, Stevens Hotel, Chicago, Ill.*

OCTOBER 14-18, 1935. *Seventeenth Annual Convention of the American Gas Association, Atlantic City, N. J.*

JANUARY 27-31, 1936. *Fourth International Heating and Ventilating Exposition, International Amphitheatre; Chicago, Ill.*

A. C. for Reading Trains

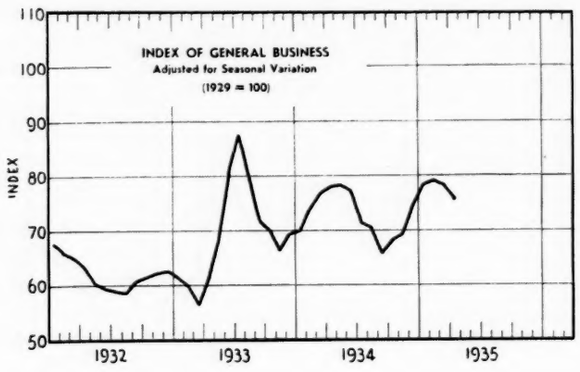
HARRISBURG, PA.—The Reading Railroad has announced the complete air conditioning of four of its trains between Harrisburg and New York, including the *Harrisburg Special* and *Queen of the Valley.*

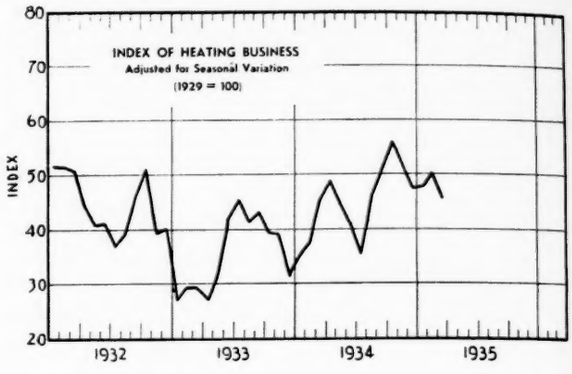
Edward Martin Adams

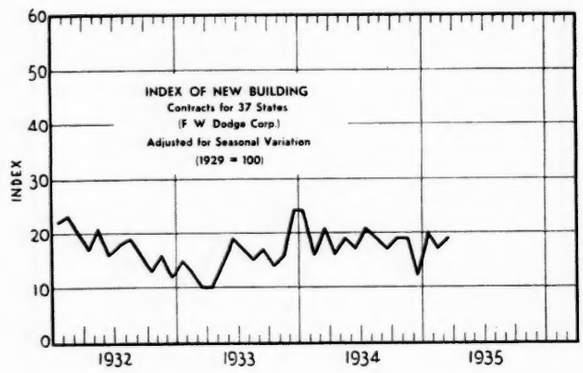
CHICAGO — Edward Martin Adams, first vice-president in charge of sales and a director of Inland Steel Company, died May 8 at Hot Springs, Ark. He was 58.

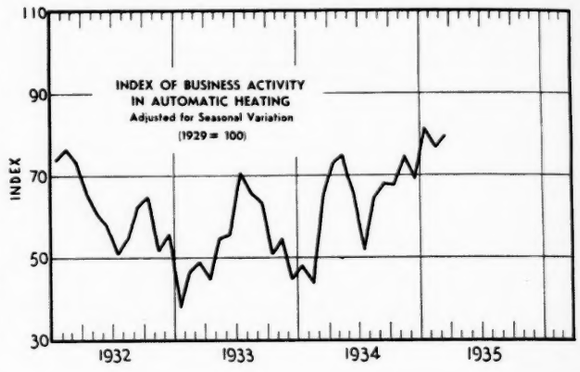
Born in Cherry Valley, Ill., Mr. Adams was at one time employed by the Illinois Central Railroad and served a term as mayor of Harvey, Ill. He was subsequently employed by the Buda Company, and in 1907 entered the employ of Inland Steel as secretary in charge of the credit department. He was elected a director in 1918 and became vice-president in 1921, also retaining the office of secretary. In 1922 he was elected to the position he held at the time of his death.

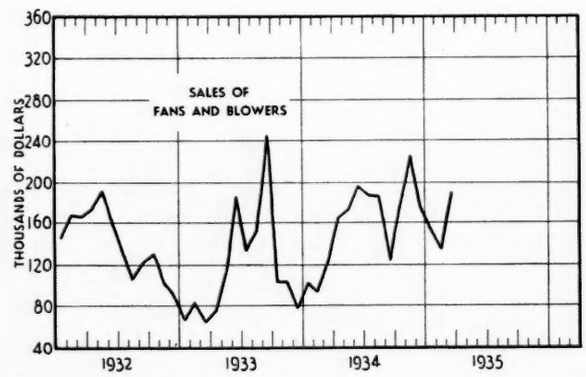
BUSINESS TRENDS

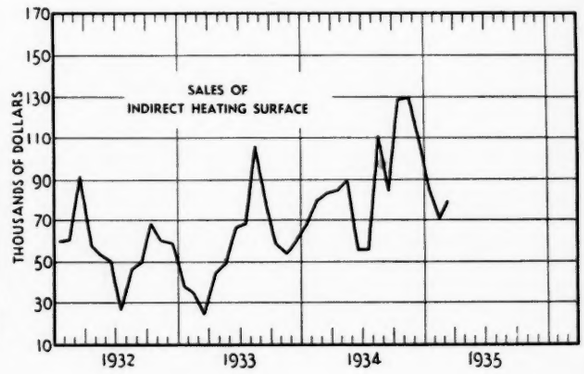


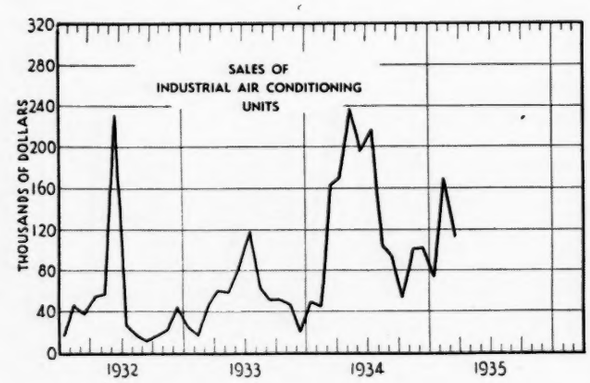


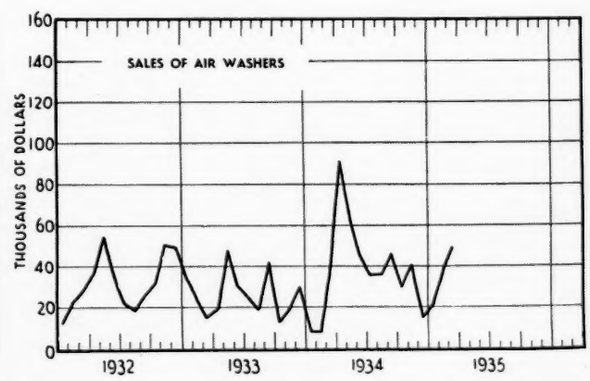












Residential Building Shows Signs of Life; Automatic Heating Up

A SHARP increase in residential building in April as compared with March, a gain greater than the usual seasonal rise; an increase in the sale of oil burners in March as compared with February, a more than seasonal gain; a sharp rise in the sale of blowers for ventilating and air conditioning systems in March as compared with a year ago and with the previous month; and an important increase in the number of loans for modernizing insured by the Federal Housing Administration during May are features among recent business trends.

During the week ending May 17 FHA insured 8917 modernizing loans, amounting to $3,481,127, the largest number and largest amount insured in a single week since the campaign started last August. Addition of these figures bring the accumulated total to 166,486 loans, totaling $69,199,582. Coincidental with this favorable news Federal Housing Administration announced a National Better Housing Day for June 15, in order to focus public attention on the fact that houses can be built, are being built and financed under government-insured mortgages for as much as 80% of the appraised value.

With the success of the modernizing program, an assured fact, FHA plans to stimulate interest in this program for insuring mortgages for new construction. Better housing committees in important cities and towns are arranging for the opening of from 1 to 25 new model homes on June 15. Ground will be broken simultaneously for all of these homes at a given hour. President Roosevelt will be asked to participate in a national ceremony to be broadcast over a national radio hookup.

Building

According to Commissioner Lubin of the Bureau of Labor Statistics, the increase in building activity shown by the statistics for the first three months of the period of 1935 continues into April. Compared with April a year ago, the value of buildings for which permits were issued shows a gain of over 65%. The gains in building, however, were confined to residential-type structures. The index of residential building (1929 = 100) rose from 17.6 in March to 21.0 in April, after adjustment for seasonal variation. A similar index, adjusted, for non-residential building dropped from 19.5 in March to 19.4 in April. In non-residential structures, however, there was an important gain in commercial building and in social and recreational building. The combined index of both residential and non-residential building rose slightly from 19 to 20.

Heating Business

Although the heating business showed a gain in March as compared with February, the increase was not as great as would be expected for the season, so that HEATING AND VENTILATING'S Index of Business Heating Activity dropped from 49.8 to 45.6. The figures are in per cent of the 1929 average and are adjusted for seasonal variation. The index of automatic heating after seasonal adjustment rose from 76.6 in February to 79.4 in March.

HEATING BUSINESS INDEXES

	INDEX OF HEATING BUSINESS	INDEX OF AUTOMATIC HEATING
March, 1935	45.6	79.4
February, 1935	49.8	76.6
March, 1934	45.1	65.1

Stocks

The general improvement which has taken place in the heating industry during the last two years has been reflected in the prices of 11 typical stocks of heating equipment manufacturing concerns. An index showing the trend of these 11 stocks, averaged, reached a high of 31.7 in April as compared with 30.0 in March. The April figure was the highest since August, 1931, and compares with a low of 10.2 in June, 1932. The stocks included in the index are those of American Radiator, Carrier, Crane, Iron Fireman, Modine, Minneapolis-Honeywell, Holland Furnace, Johns Manville, Walworth, Williams Oil-O-Matic, and Fedders.

District Steam System in Paris to be Enlarged

PARIS has had district heating since 1930. The system, operated by the "Compagnie Parisienne de Chauffage Urbain," has functioned continuously and has proved efficient even during periods of severe cold. In 1934, 17,400 ft. of pipe were in use supplying steam to residences, public buildings, and a swimming pool. Modernization and enlargement of the central heating station now under way will increase the length of the system to approximately 6.2 miles. —*"Chauffage et Ventilation."*

YOU WIN FROM

the American Radiator

FROM THE SALES ANGLE—

The Summer Payment Plan *creates* new business. It gets *more* people interested in American Radiator Heating—sends them to you—because only through the Heating Contractor can they get these extra-liberal terms.

FROM THE CASH ANGLE—

When the job is installed, you get paid at once, in full—although your customer pays nothing until fall. There are no drawbacks, no holdbacks, no holdouts, no recourse. The Summer Plan costs you *nothing* and costs your customer nothing extra.

YOU HANDLE ALL DETAILS OF FINANCING IN YOUR OFFI

THE Summer Finance Plan of American Radiator Company is the biggest thing that's happened in the heating industry! It answers every objection, overcomes every obstacle in selling heating in the summer! It will bring you new business—help you close with prospects you've already seen. Here is how it works:

You make the installations now—during what is normally your slow season. You keep your men busy, you cover your overhead and make a profit. When the job is installed, you get paid in cash, in full. No holdback, no red tape.

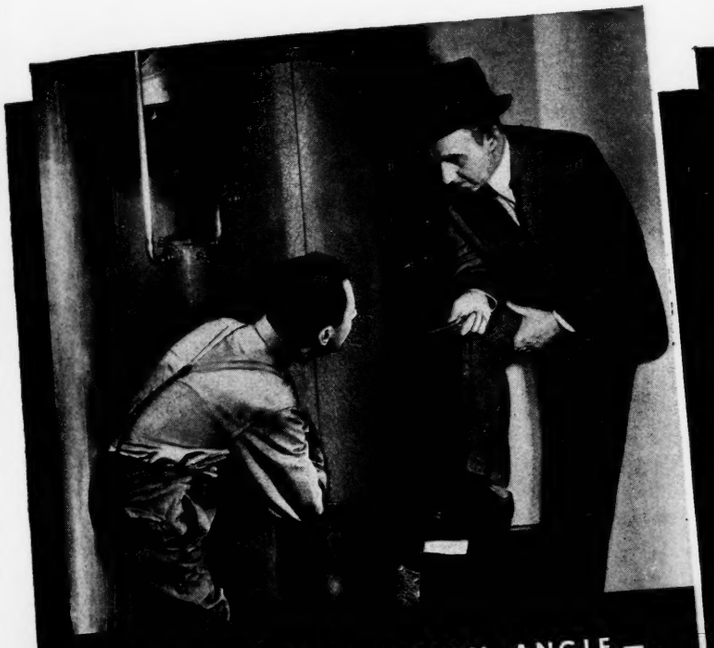
But your customer doesn't pay one cent until fall. And then he starts paying in equal monthly installments for as long as three years at low government-approved rates. He pays no interest charge or charge *of any kind* for the summer. American Radiator Company absorbs the cost of the summer credit. All the details of getting the credit are handled through you, on simple forms. Your customers need consult no one else.

People who said—"We'll wait until Fall" will be glad to get the work done now, since they don't have to pay now. People who've wanted new heating but thought they couldn't afford it, will buy now. The FHA terms and the Summer Finance Plan make it easy for every family to enjoy American Radiator Heating.

Start in this week to get profitable Summer Plan business that pays you cash. The coupon on the right brings all the necessary details. Clip it and mail it now.

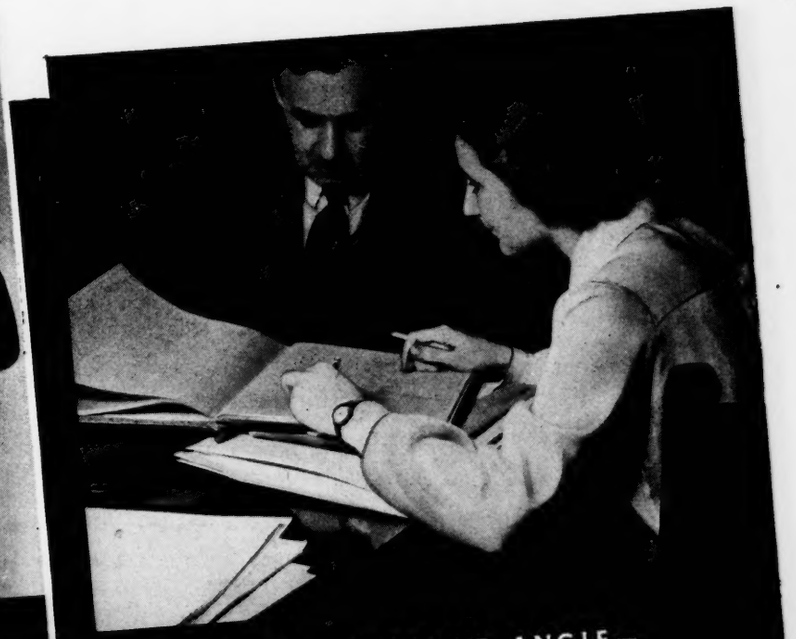
EVERY ANGLE WITH

Summer Finance Plan



FROM THE INSTALLATION ANGLE—

Here is the big chance to keep yourself and your men busy during what is normally a slow season. Moreover you're not working against time and cold weather.



FROM THE PROFIT ANGLE—

More business means more profits. And the business is steady—so that summer overhead doesn't eat up winter profits. You're in the heating business 12 months a year with the American Radiator Summer Plan. Make money every month!

..YOUR CUSTOMERS NEED CONSULT NO ONE ELSE..

AMERICAN RADIATOR COMPANY

40 WEST 40th STREET, NEW YORK, N. Y.

Division of AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

BETTER HOUSING PROGRAM

AMERICAN RADIATOR COMPANY

40 West 40th Street, New York, N. Y.

Division of AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

● **I want to get started RIGHT NOW selling on the Summer Finance Plan. Please send me all the details.**

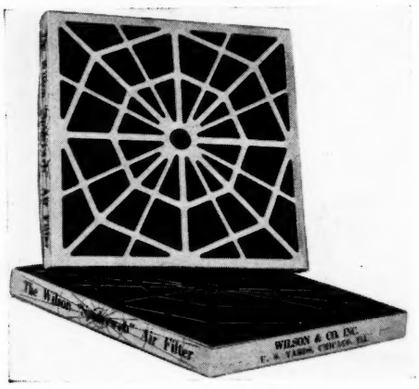
NAME.....

COMPANY NAME.....

ADDRESS.....

CITY OR TOWN..... **STATE**.....

NEW EQUIPMENT



Air filter of animal hair

Spider Web Filter

Wilson & Co., Hair Division, 4100 South Ashland Ave., Chicago, has placed on the market the Spider Web replacement-type air filter. Keratin fibers (animal hair) are used as the filter medium. The hair is sterilized and deodorized.

The central portion of the filter is built up of fibers having a high degree of resiliency in order to retain the medium in its expanded condition and to prevent packing and sagging. The outer portion is treated with a fixative to maintain the form of the pad. The back portion or outlet side of the filter is treated with an adhesive oil for catching and retaining the dust. Fibers on the filter face are formed mechanically into corrugations and are not coated with adhesive. The manufacturer claims that this allows the dust to enter the cell instead of packing up on the surface, resulting in a larger dust-holding capacity.

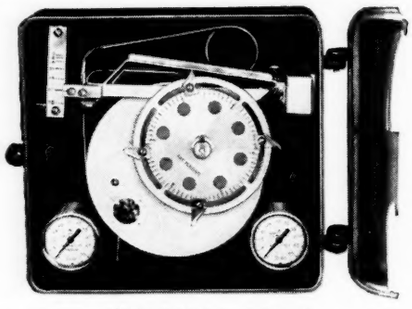
The resistance of a clean cell at 250 f.p.m. velocity is 0.05 in. of water. At 400 f.p.m., the resistance is 0.113 in. of water. As the filter takes on dust, the resistance increases so that at 335 ft. velocity and with 3.3 oz. of dust in the filter, the resistance is 0.11 in. At 300 ft. velocity and with 15 oz. of dust in the filter, the resistance is 0.18 in. of water.

Taylor Intermitter

A control instrument is available through Taylor Instrument Companies, Rochester, N. Y., for the automatic, intermittent operation of diaphragm valves or other diaphragm-operated devices. The features claimed for the instrument are: simplicity, dependability, great adaptability, and moderate price.

The device, named the Intermitter, differs in function from the company's time-cycle controller in that it is limited to the repetition of a single operation whereas the latter is capable of performing a number of different operations during the revolution of the cam.

Instead of employing the conventional fixed cam to time the intermittent operation of a diaphragm valve or other diaphragm-operated devices, the Intermitter has a circular cam on which the proper number of actuating lugs may be placed, the number of lugs corresponding with the number of operations to be performed during the rotation of the cam. As many as 20 lugs may be used. The duration of each operation is adjustable by moving the bracket carrying the nozzle (upper left corner of case) so that its scribe mark is opposite the desired time interval on the scale; the higher the position of the nozzle, the shorter the period of nozzle closure and the duration of the operation. It is by these arrangements that any change in either the number or durations of the operations, or the interval between operations, is possible without replacing or cutting the actuating cam.



Intermitter control

The actuating cam is driven by a spring-driven clock, available in 1, 6, 12, or 24-hr. periods of rotation. Electrically-driven clocks with identical periods of rotation also can be supplied.

The instrument is available in two types: reverse-acting lugs — to close nozzle, applying pressure to diaphragm motor—and direct-acting—lugs to open nozzle, relieving pressure from diaphragm motor.

A waterproof, non-corrosive aluminum case with black crackle finish protects the mechanism. Pressure gauges are located within the case to protect them from breakage and discoloration.

Boyle Velometer

The Boyle Velometer is being offered by the Illinois Testing Laboratories, Inc., 420 North La Salle St., Chicago. It is a direct reading air velocity meter which is said to give accurate and instantaneous readings of the speed and direction of air motion measured in feet per minute.

Direct-reading air velocity meter

It is housed in a black bakelite case 5¼ in. x 5¾ in. x 2⅜ in. in size and weighs approximately 2 lb.

The air enters through a port (or a jet and tube depending on the style used) and leaves through a port on the right side of the meter. This air passing through the meter actuates a movement comprising a vane, control springs, pointer, and magnetic damping system. A pointer locking button is provided to lock the pointer to retain the reading or when the instrument is not in use.

The device is furnished in two types each with a double range scale. The shutter type is furnished with a shutter for opening or closing the port for changing the range. This type is designed to take quick commercially accurate readings such as in heating and ventilating and air conditioning work. With the tube type, when used for the low-range readings, the tube attachment is removed and the air enters directly through the port. For high-range readings, tube attachment with a suitable jet is used. The air enters through this jet. As the tube is flexible the jet can be moved about while the instrument is stationary.

A.T.C. Time Control Unit

Automatic Temperature Control Co., Inc., 34 East Logan St., Philadelphia, has announced the series 1274-5-6 time controls, designed to repeat one or two operations or processes as often as desired. Provision has been made for flexible choice of periods during which the controlled actions take place. The time controls in this series will handle a repetitive action or operation requiring a definite time period or cycle with either the same or different time period between successive time cycles. The time cycle and also the interval between successive cycles is infinitely adjustable with an accuracy of setting to within a split scale division of the respective dial ranges selected.

Shepard Oil Burner

Shepard Heating Equipment Corp., Brooklyn, N. Y., has introduced an improved oil burner designed for apartment houses, public buildings, and industrial plants. It burns No. 6 oil.

The manufacturer claims that this burner is entirely automatically electrically controlled and that it starts instantly even in the coldest weather. Oil is pumped from the storage tank to the boiler oil preheater, where the oil is heated so as to allow it to be broken up and atomized under low pressure. Both burner and pump are installed entirely outside the boiler. Nozzles project into the lower part of the furnace.

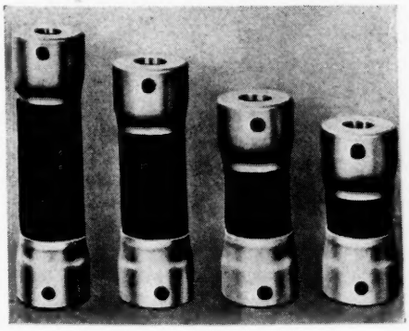
Heatomagic

General Foundry & Manufacturing Co., P. O. Box 119, Flint, Mich., is manufacturing and the Heatomagic Corporation of the same address is selling a warm-air furnace which is in reality a bituminous coal converter reducing cheap yard slack soft coal to gas and coke. It holds up to 200 lb. of fuel at one charging. Its combustion efficiency is said by the manufacturers to be from 85 to 90% on stack temperatures as low as 450°. By means of the design the smoke, free carbons and gases which are baked out of the coal are passed through the incandescent coke bed and completely burned.

Flexible Drive Coupling

An improved type of drive coupling for fractional horsepower motors, designed to reduce transmission of noise and motor torque vibration from the motor to the driven shaft, has been introduced by Guardian Utilities Co., 1023 East 46 St., Chicago. It is made of flexible rubber, treated to resist action of oils, and offered in various lengths to eliminate extra cost of shaft extensions.

The device is said to operate under reasonable lateral or angular misalignment without binding, friction, or noise. It is suitable for use with cushioned or spring motors, either base or flange-mounted.

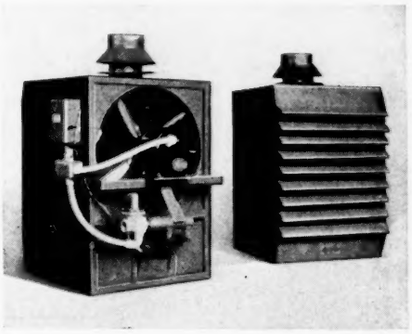


Flexible drive couplings

Hi-Test Cast-Iron Pipe

A Hi-Test cast-iron pipe, developed for water and gas lines, has been announced by Walworth Co., 60 East 42nd St., New York. The pipe is suitable for water working pressures of 175 lb. per sq. in. It is regularly furnished in sizes 1¼ in. to 6 in. inclusive, in 20-ft. lengths, with threaded joints for rapid assembly above ground, and can also be supplied in 5, 10, and 15-ft. lengths. Expansion joints, made up with open end wrenches after sections as long as 80 to 100 ft. have been lowered into the trench, provide for axial and to some extent for lateral movement, and assure a bottle-tight joint under the service conditions for which the pipe has been designed.

Cast iron used in the Hi-Test pipe has an ultimate tensile strength of 35,000 lb. per sq. in. Minimum bursting pressures for the threaded pipe range from 7,000 lb. per sq. in. for the 1¼-in. diameter size to 1,500 lb. per sq. in. for the 6-in. size. If required, each length will be tested to a hydrostatic pressure of 500 lb. per sq. in.



Suspended type gas unit heater

Thermidaire Gas Unit Heater

E. K. Campbell Heating Co., 2441-45 Charlotte St., Kansas City, Mo., has introduced the Thermidaire gas-fired unit heater of the suspended ceiling type. The products of combustion pass from the combustion chamber through large rectangular flues up and down on each side, then up to the gathering box on top and out to the vent flue, giving three passages of the hot gas. Heating surface is of the U-fin type, the fins being electrically welded to the sides of the sections. The unit is mounted in a wrinkled baked enamel case with fireproof sound and insulating material. The controls include a safety pilot and other standard devices.

The units are available in eight sizes with inputs ranging from 60,000 to 400,000 B.t.u. per hr., or equivalent steam radiator rating ranging from 200 to 1333 sq.ft.

The company also supplies a floor-type unit.

Frigidaire Room Units

The air conditioning division of Frigidaire Corp., Dayton, Ohio, announces two new air conditioning units—the SC-40 and SC-80.

The two additions to the company's line of equipment for unit or central system installations are self-contained and equipped with thermostatic controls and outside ventilation with air filters. The units are available in burled walnut shells and are of conventional design.

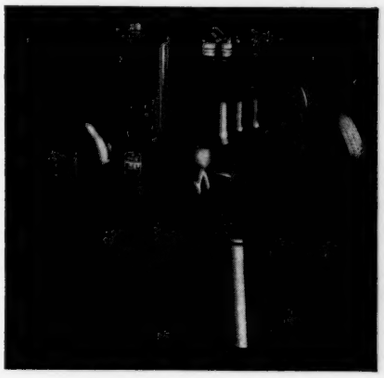
The SC-40 has a refrigeration capacity of approximately ⅜ ton, and the SC-80 approximately ¾ ton. Both are designed for individual installations, particularly in homes and offices. The smaller unit will retail for $420, f o.b. Dayton, and the larger one for $579.

York Commercial Machines

Extension of its line of Balanseal condensing units from 7½ to 25 hp. is announced by York Ice Machinery Corp., York, Pa., increasing the number of machines in this series to 18. At the same time, three new horizontal type air conditioners, in capacities up to 30 tons of refrigeration, are being introduced as related equipment.

The new condensing units are designed for a variety of needs in meat markets, restaurants, produce houses, bakeries, dairies, florists, and other commercial refrigeration requirements. The new models are shipped complete with motor, compressor, receiver and automatic controls mounted on one base.

Model 44T6FW is a 10-hp. single compressor, while the other new models are duplex units, with a motor mounted in the center of the base and belted to identical compressors at each end. Thus the 15-hp. unit, model 446FWD, is a duplex machine comprised of two two-cylinder compressors. The 20 and 25-hp. units, models 44T6FWD and 44T8FWD, have two three cylinder compressors.



York 10-hp. condensing unit

Peerless Attic Fan and Furnace Blower

The Peerless Electric Co., Warren, Ohio, has announced an attic ventilating unit. This device is said to be so suspended that it is not possible to transmit rotational vibration to the house structure.

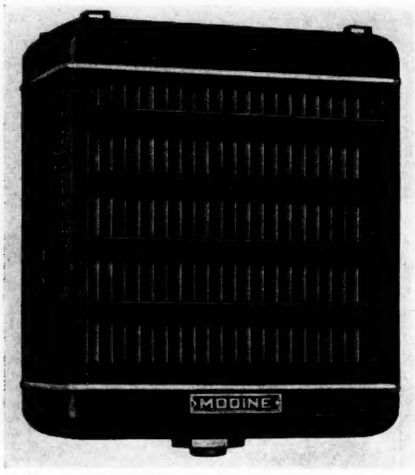
The company has also placed on the market a belted furnace blower with a floating power motor and automatic compensation so as to insure correct belt tension at all operating speeds. This unit is available in one size only complete with outer cabinet and filters, the outer cabinet having removable sides.

Modine Unit Coolers

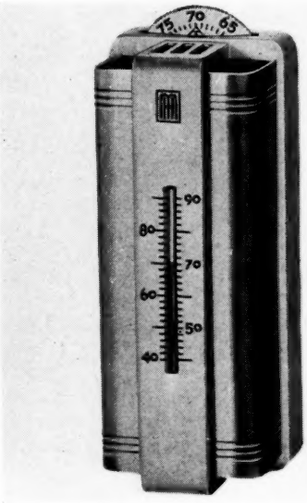
Heating Division, Modine Manufacturing Co., Racine, Wis., has announced its 1935 line of unit coolers for space cooling, available in two types and seven sizes, designed for comfort cooling in restaurants, stores, and offices, and for process cooling in industrial plants.

The units can be used for both cooling and heating but with one line—the cold water type unit cooler—cold water cooling can be combined with steam heating applications. This type unit is in general identical in construction with the company's unit heaters, hot water type, fitted with moisture eliminator assembly, for the collection of moisture from the atmosphere. Practically any cooling medium may be used, such as deep well or tap water, non-corrosive brine, or water chilled by ice or mechanical means. The moisture eliminator assembly may be removed in the fall.

The direct expansion type has the same scope of application as the cold water type but has a specially constructed core. It is used in conjunction with a compressor, employing direct expansion gases for the cooling medium.



Modine unit cooler



Acratherm thermostat

Minneapolis-Honeywell Acratherm

The Acratherm thermostat has been announced by Minneapolis - Honeywell Regulator Co., Minneapolis. Two models are available, type T10, an improved model, and type T11, which has a heat acceleration feature as well as the other features of type T10. Type T10 operates much the same as the company's series 10 thermostats, except that it reacts more rapidly to surrounding temperatures.

Type T11 has in addition a medium for producing artificial heat. It is so constructed that when the room temperature falls below the designated temperature the burner or gas valve is turned on. As soon as there is a slight rise in the room temperature one of the contacts in the thermostat opens and turns on the small heater in the thermostat. The burner is not, however, shut off. The artificial heat accelerates the normal action of the thermostatic element, and the contact which controls the burner operation opens faster than usual, shutting off the burner. The time of the operation of the burner after the heater is turned on depends directly on temperature differential to be maintained. With a 2° differential, the time of operation of the burner after the heater is turned on is about seven minutes; with a 3° differential it is about thirteen minutes, and 4° about thirty minutes. The overall length of burner operation would be the timing mentioned plus the time elapsing before the thermostat heater was turned on.

It is claimed that the advantage of the heat acceleration principle is due to the fact that artificial heat is not applied until there has been a sufficient rise in the room temperature to open the first contact, and that the total time of the burner operation is directly dependent upon the extent of the variables present at the time.

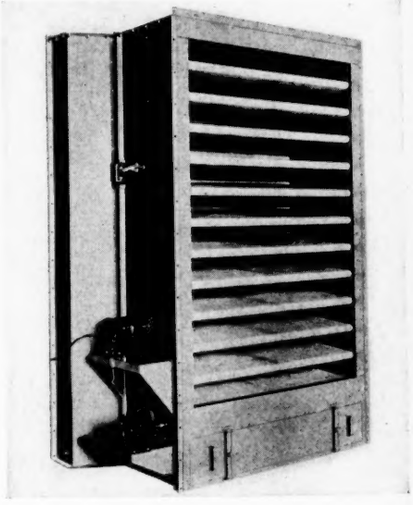
Coppus Dry-Matic Filter

Dry-Matic is the name selected by Coppus Engineering Corp., Worcester, Mass., for its new automatic, self-cleaning, dry-type filter. This filter uses cotton fabric as the filter medium. When the air passes through this filter material, the dust particles are sifted out and deposited on the filter curtain. Once a day to once a week, according to the dust concentration in the air, the filter curtain starts to move slowly over a dust drawer at the bottom of the filter housing and at the same time a rotary beater is set in operation.

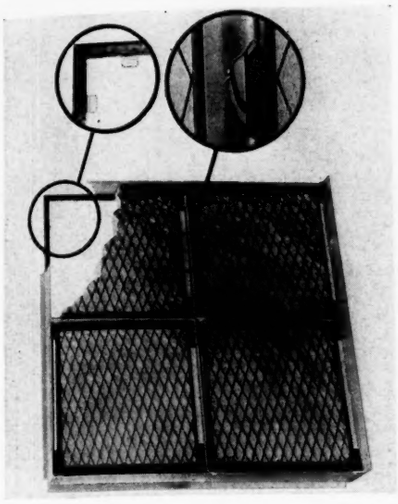
This may be accomplished either manually or automatically. Because of its operating flexibility, the manually-operated pushbutton is furnished as standard equipment on the filter. An automatic time clock that starts the motors at definite time intervals can be furnished.

Leather fringes beat the curtain on the clean air side with the result that all dust is shaken off into the dust drawer. After a cleaning cycle which lasts from 8 to 15 min., according to the height of the filter, the drive motor as well as the beater motor stops automatically. The attention necessary for this automatic operation is the removal of the accumulated dust from the dust drawer three to four times a year.

The filter element runs in a zig-zag fashion, in the shape of an endless belt, over rolls, thus forming horizontal, tapered pockets. Both edges of the filter curtain are reenforced by cords to which are attached chains in an endless loop. On the ends of the rolls are mounted sprockets on which the chains run. To prevent the bypassing of uncleaned air the edges of the filter curtain pass through a labyrinth seal, formed between interlocking tapered side plates.



Dry-Matic filter



Frame for Dustop filters

Dustop Filter Frame

An air filter frame for use with Dustop filters is now available through the Owens-Illinois Glass Co., Toledo. It employs a felt strip between filter and frame against which the filter is tightly held by a simple wedge lock. This arrangement is said to provide a positive seal that prevents leakage of dirt-laden air at any point.

The circle at the left in the illustration shows a closeup view of the square felt strip, which is inserted when the frame is constructed and which is held permanently in place by bending the metal tabs over the frame flanges.

The circle at the right shows the detail of the wedge lock which is applied on the intake side of the frame to force the filter firmly against the felt "gasket." This device is easy to put on or remove and is self-adjusting to variations in thickness of the filters in the bank.

The Dustop replacement-type filter itself has, according to the maker, undergone improvements which give it still lower air resistance than formerly, but is available, with the improved frame equipment and including all necessary bolts and nuts, at a cost of one cent per c.f.m. as previously.

Crane Well Water Cooling System

Crane Co., Chicago, has introduced a home cooling system which uses well water as a cooling medium. It is claimed that from four to eight rooms can be completely cooled and filtered for less than $800 installation cost, including the cost for drilling an average well and with operating costs running from not more than $12 to $15 per season.

The equipment consists of a water pump connected to a deep well, cooling coil and fan, filter, thermostat, and ducts.

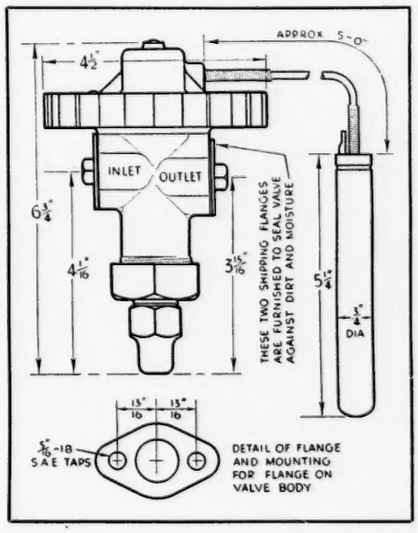
The system can be used in connection with a warm-air furnace system in which case the existing ducts are used. If a radiator system is installed in the house it is necessary to install a separate system of ducts.

Expansion Valve for Air Conditioning

The Model 220 thermostatic expansion valve for air conditioning has been introduced by Automatic Products Co., Milwaukee, Wis. Its function is to keep the evaporator coils filled with liquid and to cut off the flow of liquid to prevent flooding into the compressor. It is intended for use with Freon or methyl chloride and can be used wherever a thermostatic valve is applicable.

The valve has a minimum number of parts and operation is simple. As the pressure difference between the power element and evaporator inlet increases (corresponding with increase in superheat above the value incident to the evaporator temperature), a double diaphragm forces the needle valve open. As this pressure difference is reduced, a spring reduces the valve opening.

The valve has a superheat range adjustable between 3° and 18°. The superheat increases as the evaporator temperature rises. Since there is a decrease of superheat with a reduction in evaporator temperature, the compressor does not operate as long at reduced suction pressure, and the energy input over a cycle is thereby reduced by that action. Body parts are of brass forgings, the valve seat of stainless steel, and the needle of stellite. The valves are made in six models, three for each of the two types of refrigerant and with orifice sizes of 0.200, 0.250, and 0.375 in.



Model 20 thermostatic expansion valve

Steel boiler for oil burning

National Oil-Burning Steel Boiler

National Radiator Corp., Johnstown, Pa., has introduced a line of steel oil-burning boilers. with jacket designed by Lurelle Guild. The front and back of the jacket are removable. The boiler is shipped completely assembled, ready for installation.

Mechanical features of the boiler include cylindrical, water-backed, refractory-lined combustion chamber; three-pass flue gas travel and built-in indirect water heaters.

The boilers are being placed on the market in combination with Williams Oil-O-Matic burners. Units utilizing other types of burners will be subsequently placed on the market in some sections of the country.

The boilers are available in five sizes with outputs from 200 sq. ft. to 1000 sq. ft. of steam radiator.

Gardner Centrifugal Pumps

A line of double suction, single-stage split case centrifugal pumps, has been announced by Gardner-Denver Co., Quincy, Ill. This line is said to be adaptable to practically any class of service, and is recommended for general water supply in municipalities, industrial establishments, office buildings, and similar installations, due to their compactness and high efficiency.

The pumps are designed for any type of drive, including flat belt, V-Belt, direct connected, gas or diesel engine, although the usual drive is connected directly to an electric motor.

All pumps in the D, E, F, and G series are identical in construction, the only difference in pumps being in dimensions. This series of pumps covers all heads up to approximately 300 ft., each type of pump covering a certain percentage of head and thus enabling the buyer to select the exact type of pump for any head up to 300 ft.

Anchor Oilmotor Stoker Drive

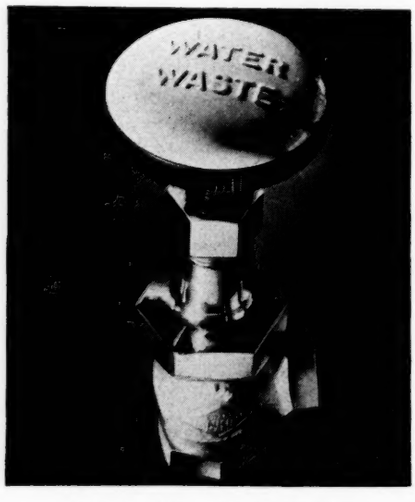
The Anchor Stove and Range Co., New Albany, Ind., has placed on the market a stoker drive utilizing the hydraulic principle. It is to be known as the Oilmotor stoker drive. The heart of the drive is a high-pressure oil pump developing 200 lb. pressure, which delivers oil to a double ended cylinder. The pump is located on the same shaft

Oilmotor stoker drive

that drives the fan and is driven by the same motor through a V-belt. There are 22 sizes and models available.

Jenkins Colored Valve Wheels

A valve wheel molded of colored plastic materials has been developed by Jenkins Bros., New York, for special use on their valves, to make it possible to designate valves for steam, water, air, or any other fluids and gases by distinctive colors. Five standard colors —blue, red, black, green, and gray— are offered, unmarked and with five standard service markings molded in relief. The company also offers to make up wheels of special color.



Valve with colored wheel

Arco Air Filter

A corrugated fiber-board air filter, of the replacement type, said to give uniform resistance and efficiency, thus reducing power costs in air conditioning operations, has been placed on the market by the industrial division of American Radiator Co., New York.

The filter is composed of two wafers of the corrugated fiber board placed together so that the cellular passages in the two boards, which are cut at a 45° angle, form a V-shaped passage with a 90° angle in it. These cause the air flow to change direction twice.

The entire filter is coated with a compound that saturates dust, catching it in the filter. Each dust particle as it is saturated becomes a medium for catching other dust. The coating will not become rancid, remains tacky at —10°, and will not drop at 180°.

Three models of the filter are offered, one in which the corrugated wafers have 3/16 in. cellular passages on both the inlet and the outlet sides for industrial applications. Another, for ventilating on air conditioning systems where outside air has to be cleaned, has 5/16 in. passages in the inlet wafer with smaller 3/16 in. passages in the outlet wafer. The third,

Arco replacement type filter

which has been designed for use where the major part of the air filtered is recirculated air, has ½ in. passages for the inlet wafer and 5/16 in. passages in the outlet wafer.

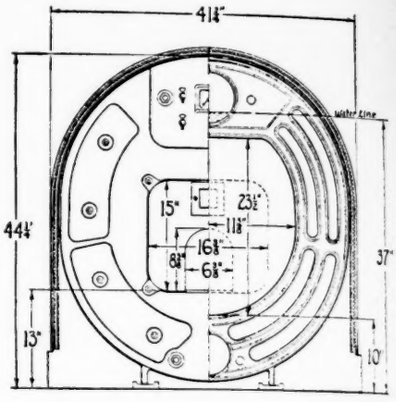
Ideal Convector Gate Valve

A gate valve especially built for convector radiators has been placed on the market by American Radiator Co., New York. Designed to offer a compact straightway valve that can be used conveniently within the restricted dimensions found in enclosures, it has a female union on one end to facilitate installation when a bottom connection is used on radiators of this type.

A male thread on the other end screws directly into the convector before the latter is set in position. The union connection is then screwed down over the stub after the radiator has been placed, and the operation is complete. Moderately priced, the product is known as the No. 375 Ideal convector gate valve.

Oil-Economy Oil-Burning Boiler

International Heater Co., Utica, N. Y., has introduced the Oil-Economy oil-

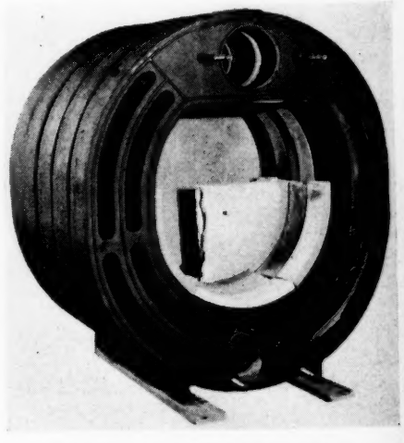


Sectional view of Oil-Economy boiler

burning, cast-iron boiler. This boiler is of elliptically-shaped sections with the combustion chamber in the center and two rows of secondary heating surface around the periphery. The flue travel is toward the rear and the gas then travels toward the front of the boiler in the first row, and toward the rear in the second space, and then out the flue. The circular firebox is said to eliminate dead corners and since it is entirely surrounded by water there is no radiant heat loss. The top of the firebox is covered by a comparatively small amount of water and consequently heats quickly.

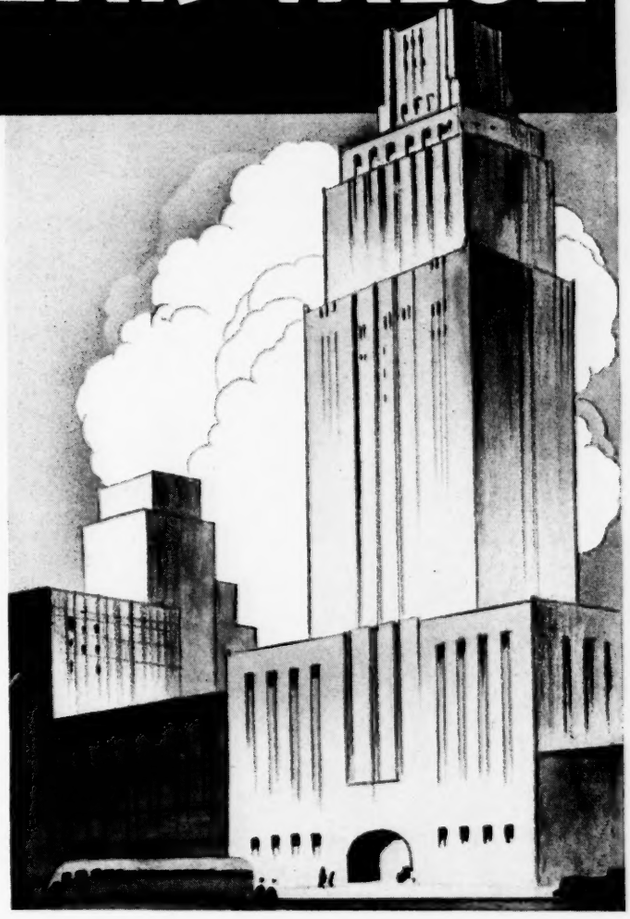
The boiler is designed to fit only gun-type burners. It is made in four sizes with net radiator loads of 400 to 1000 per sq. ft. of steam.

The unit includes McDonnell & Miller low water cut-off combination or cut-off only, and Taco water heater.



Section of oil-burning boiler

HERE'S GREATER DOLLAR VALUE



...for soil, waste, vent lines and rain leaders

Dollar for dollar — Copper-Steel Pipe will yield better profits for the owner when used for soil, waste, and vent lines, rain leaders, and steam returns in buildings. Further, engineers and heating and ventilating contractors can build prestige and confidence in their knowledge of progressive plumbing and heating practice by specifying copper-steel for these services. Over 20 years of service tests have proved that copper-bearing steel has a special resistance to atmospheric corrosion, or alternate wet and dry conditions. Therefore, in the services indicated, Copper-Steel Pipe lasts longer and greater economy will follow its use. The extra cost is negligible—just a trifle above that of regular steel pipe. Begin now to specify NATIONAL Copper-Steel Rust-Resisting Pipe and obtain for your clients greater dollar value for their investment. Descriptive literature sent upon request.

NATIONAL TUBE COMPANY • Pittsburgh, Pa.
Pacific Coast Distributors—COLUMBIA STEEL CO., San Francisco, Calif.
Export Distributors—UNITED STATES STEEL PRODUCTS CO., New York, N. Y.

United States Steel Corporation Subsidiary

LOOK FOR THE GREEN COLOR!

National Copper-Steel Pipe is marked as follows: Black Pipe—Smaller sizes, colored green. Larger sizes, two green stripes running lengthwise. Galvanized Pipe—All sizes, two green stripes running lengthwise.

NATIONAL
COPPER-STEEL
RUST RESISTING PIPE

Degree-Days and Unit Fuel Consumption—April, 1935

Continuing HEATING AND VENTILATING's seventh year of publishing degree-day data for various large cities in the United States

	Atlanta	Baltimore	Birmingham	Boston	Buffalo	Chicago	Cincinnati	Cleveland
Degree-days for April, 1935.....	155	392	130	601	720	636	441	612
Degree-days, Sept. 1, '34 to April 30, '35	2756	4231	2301	6006	6390	5732	4487	5427
Degree-days, Sept. 1, '33 to April 30, '34	2832	4704	2275	6293	7091	5964	4983	6036
Degree-days, Sept. 1 to April 30, Normal	2890	4511	2352	5800	6474	6042	4684	5935
Lb. coal per sq. ft. rad., April, 1935.....	1.240	3.136	1.040	4.808	5.760	5.088	3.528	4.896
Gal. oil per sq. ft. rad , April, 1935.....	0.106	0.269	0.089	0.412	0.494	0.436	0.302	0.420
Cu. ft. gas per sq. ft. rad., April, 1935...	14.88	37.63	12.48	57.70	69.12	61.06	42.34	58.75

	Denver	Des Moines	Detroit	Duluth	El Paso	Fort Wayne	Grand Rapids	Harrisburg
Degree-days for April, 1935.....	582	502	618	876	53	565	606	465
Degree-days, Sept. 1, '34 to April 30, '35	4720	5851	5653	8745	2078	5671	6098	5102
Degree-days, Sept. 1, '33 to April 30, '34	4141	5903	6639	9223	1939	6232	6754	5644
Degree-days, Sept. 1 to April 30, Normal	5607	6266	6264	8721	2428	5804	6361	5285
Lb. coal per sq. ft. rad., April, 1935.....	4.656	4.016	4.944	7.008	0.424	4.520	4.848	3.720
Gal. oil per sq. ft. rad., April, 1935.....	0.399	0.344	0.424	0.601	0.036	0 387	0.416	0.319
Cu. ft. gas per sq. ft. rad., April, 1935...	55.87	48.19	59.33	84.10	5.09	54.24	58.18	44.64

	Hartford	Indianapolis	Kansas City	La Crosse	Los Angeles	Louisville	Memphis	Milwaukee
Degree-days for April, 1935.....	525	488	398	576	139	342	196	703
Degree-days, Sept. 1, '34 to April 30, '35	5818	4883	4426	6906	1170	3898	2691	6414
Degree-days, Sept. 1, '33 to April 30, '34	6326	5417	4336	7024	819	4360	2881	6586
Degree-days, Sept. 1 to April 30, Normal	5834	5239	4840	7139	1414	4180	2950	6856
Lb. coal per sq. ft. rad., April, 1935.....	4.200	3.904	3.184	4.608	1.112	2.736	1.568	5.624
Gal. oil per sq. ft. rad , April, 1935.....	0 360	0.335	0.273	0.395	0.095	0.235	0.134	0.482
Cu. ft. gas per sq. ft. rad., April, 1935...	50.40	46.85	38.21	55.30	13.34	32.83	18.82	67 49

	Minneapolis	New Haven	New Orleans	New York	Oklahoma City	Omaha	Peoria	Philadelphia
Degree-days for April, 1935.....	627	510	19	475	232	473	510	412
Degree-days, Sept. 1, '34 to April 30, '35	7393	5536	948	5042	2992	5407	5431	4564
Degree-days, Sept. 1, '33 to April 30, '34	7501	6067	854	5551	3109	5364	5756	4946
Degree-days, Sept. 1 to April 30, Normal	7614	5672	1024	5192	3613	6047	5988	4787
Lb. coal per sq. ft. rad., April, 1935.....	5.016	4.080	0.152	3.800	1.856	3.784	4.080	3.296
Gal. oil per sq. ft. rad., April, 1935.....	0.430	0.350	0.013	0.326	0.159	0.324	0.350	0.283
Cu. ft. gas per sq. ft. rad., April, 1935...	60.19	48.96	1.82	45.60	22.27	.45.41	48.96	39.55

	Pittsburgh	Portland, Ore.	Providence	Reading	Rochester	St. Louis	Salt Lake City	San Francisco
Degree-days for April, 1935.....	458	398	555	453	622	397	459	197
Degree-days, Sept. 1, '34 to April 30, '35	4815	3784	5757	5014	6236	4127	4974	2104
Degree-days, Sept. 1, '33 to April 30, '34	5613	3019	6171	5469	6904	4402	3904	1856
Degree-days, Sept. 1 to April 30, Normal	5157	4134	5763	5293	6472	4585	5319	2418
Lb. coal per sq. ft. rad , April, 1935.....	3 664	3.184	4.440	3.624	4.976	3 176	3.672	1.576
Gal. oil per sq. ft. rad , April, 1935.....	0.314	0.273	0.381	0.311	0.427	0.272	0.315	0.135
Cu. ft. gas per sq. ft rad., April, 1935...	43.97	38.21	53.28	43.49	59.71	38.11	44.06	18.91

	Scranton	Seattle	Spokane	Syracuse	Toledo	Trenton	Washington, D. C.	Wichita
Degree-days for April, 1935.....	571	426	594	621	592	469	413	374
Degree-days, Sept. 1, '34 to April 30, '35	5884	3967	5610	6297	5775	5086	4288	3983
Degree-days, Sept. 1, '33 to April 30, '34	6390	3449	4672	6912	6357	5659	4714	3873
Degree-days, Sept. 1 to April 30, Normal	5958	4397	5989	6614	5893	4852	4601	4673
Lb. coal per sq. ft. rad., April, 1935.....	4.568	3 408	4.752	4.968	4.736	3.752	3 304	2 992
Gal. oil per sq. ft. rad., April, 1935.....	0.392	0 292	0.407	0.426	0.406	0.322	0.283	0.256
Cu. ft. gas per sq. ft. rad., April, 1935...	54.82	40 90	57.02	59.62	56.83	45.02	39.65	35.90

Fuel consumption figures given above are based on certain conditions, and for other conditions corrections must be made. The figures assume the use of steam radiators emitting 240 B.t.u. per sq. ft. per hr., a system operating at 100% efficiency, and radiators calculated for maintaining 70° in zero weather. Heating values assumed for the fuels are 12,000 B.t.u. per lb. for coal, 1000 B.t.u. per cu. ft. for gas, and 140,000 B.t.u. per gal. for oil. To correct for other heating values, efficiencies, and design conditions, follow the method explained in the "Heating and Ventilating Degree-Day Handbook."

Announcing

CRANE SUMMER FINANCE PLAN

For Selling Crane Boilers and Radiation

NO PAYMENTS UNTIL OCTOBER 2

The Crane Boiler especially equipped for oil-burning, with front mounting plate. A score of points in this boiler make for efficiency.

● Think of it! You can round up your heating prospects and get action *today!* Don't wait until fall. Crane Heating Systems installed now require *not one cent* of payment until October 2, with no money down, three years to pay, government approved rates, no interest until October 2.

Nationally advertised, Crane Boilers and Radiation are accepted with the same esteem in which all Crane materials are held. Carefully and scientifically engineered, these boilers represent an amazing advance in ease of installation, in efficiency, in durability.

The public is asking for heating dependability—and gets it in Crane Boilers and Radiation. With the Crane Summer Finance Plan, you are in a position to make quick, profitable sales. Ask your Crane representative for full particulars.

CRANE

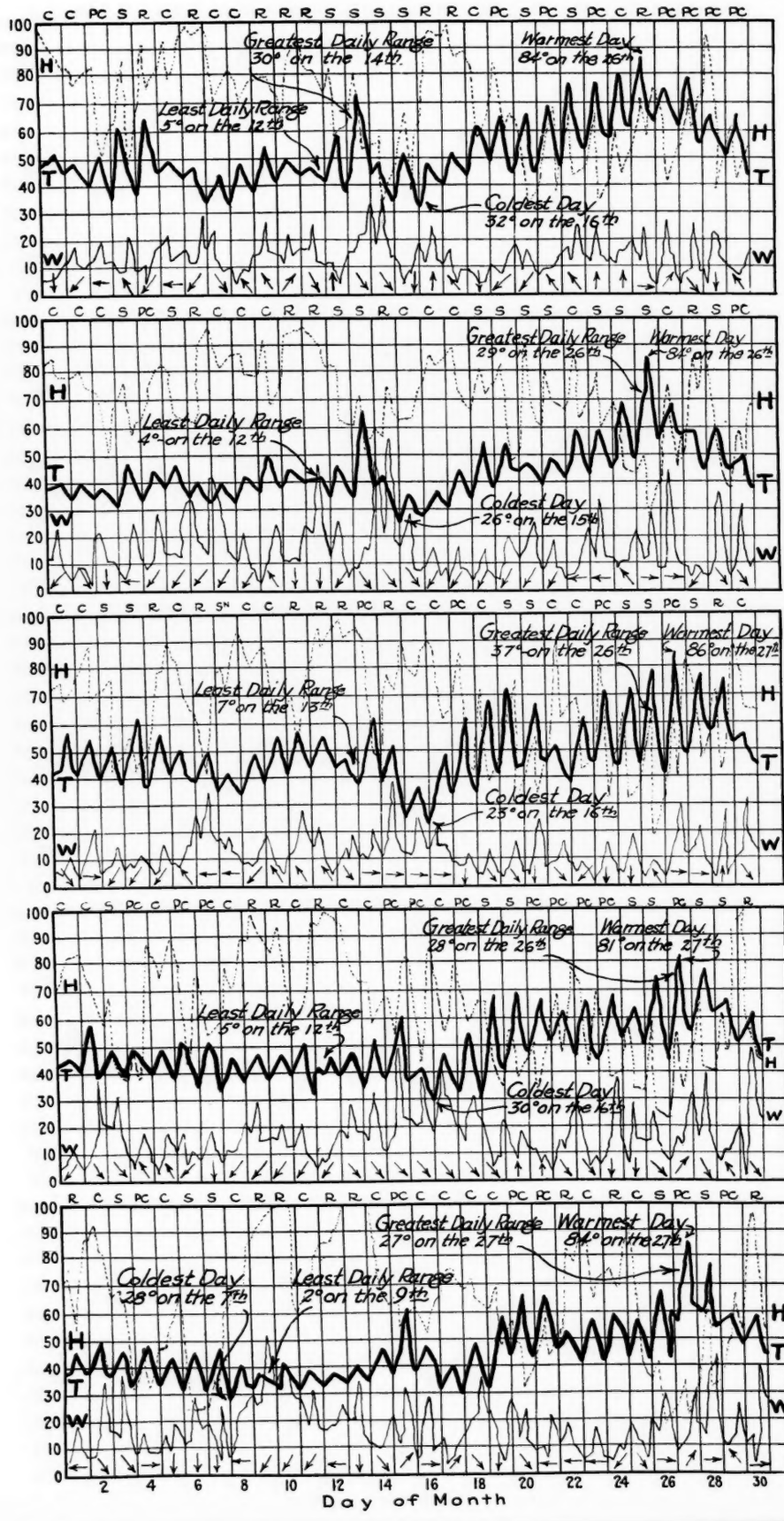
CRANE CO., GENERAL OFFICES: 836 S. MICHIGAN AVE., CHICAGO, ILLINOIS • NEW YORK: 23 W. 44TH STREET

Branches and Sales Offices in One Hundred and Sixty Cities

VALVES, FITTINGS, FABRICATED PIPE, PUMPS, HEATING AND PLUMBING MATERIAL

THE WEATHER FOR APRIL, 1935

Plotted from records especially compiled for HEATING AND VENTILATING by the U. S. Weather Bureau. Heavy curves (T), temperatures in deg. F.; dotted lines (H), per cent relative humidity, from readings at 8 a.m., noon, and 8 p.m., except for New York, which shows hourly readings. Light lines (W), wind velocity in m.p.h. Arrows indicate prevailing wind directions. S—clear; PC—partly cloudy; C—cloudy; R—rain; Sn—snow.


Greatest Daily Range 30° on the 14th
Warmest Day 84° on the 26th
Least Daily Range 5° on the 12th
Coldest Day 32° on the 16th
Greatest Daily Range 29° on the 26th
Warmest Day 81° on the 26th
Least Daily Range 4° on the 12th
Coldest Day 26° on the 15th
Greatest Daily Range 37° on the 26th
Warmest Day 86° on the 27th
Least Daily Range 7° on the 13th
Coldest Day 25° on the 16th
Greatest Daily Range 28° on the 26th
Warmest Day 81° on the 27th
Least Daily Range 5° on the 12th
Coldest Day 30° on the 16th
Greatest Daily Range 27° on the 27th
Warmest Day 84° on the 27th
Coldest Day 28° on the 7th
Least Daily Range 2° on the 9th
Day of Month

St. Louis

Mean temp. for month, 52.4°; aver. wind velocity, 11.8 m.p.h.; prevailing direction of wind, N.E.

Chicago

Mean temp. for month, 44.0°; aver. wind velocity, 11.5 m.p.h.; prevailing direction of wind, N.E.

Pittsburgh

Mean temp. for month, 50.0°; aver. wind velocity, 10.6 m.p.h.; prevailing direction of wind, W.

New York

Mean temp. for month, 49.6°; aver. wind velocity, 15.1 m.p.h.; prevailing direction of wind, N.W.

Boston

Mean temp. for month, 45.2°; aver. wind velocity, 15.4 m.p.h.; prevailing direction of wind, W.

Storage Heaters of *durable, rustless* Everdur in Pennsylvania State Highway Garages

Everdur storage heater, designed for 100 lbs. working pressure, made by PATTERSON-KELLEY CO., INC., New York, for Pennsylvania State Highway Garage at Easton. Has a storage capacity of 118 gallons and an hourly heating capacity of 100 gallons.

IN the Pennsylvania State Highway Garage at Easton, this storage heater of rustless Everdur Metal will deliver clean, *rust-free* hot water indefinitely . . . with a minimum of maintenance expense. For Everdur *cannot* rust! The heater illustrated is one of several recently built for the Pennsylvania State Highway Commission. And it is one of many Everdur heaters giving economical, trouble-free service in apartment houses and office buildings, textile mills and laundries, hospitals and other institutions.

Everdur is truly the ideal metal for non-rust heater shells. Though nearly all copper, it has the strength and good welding properties of medium carbon steel. Everdur is made in all commercial shapes, including tank plates with physical properties comparable to those specified for steel boiler plate in the A.S.T.M. Code. For additional data and names of fabricators, address our nearest office.

ANACONDA
from mine to consumer

THE AMERICAN BRASS COMPANY
General Offices: Waterbury, Connecticut
Offices and Agencies in Principal Cities

EVERDUR METAL
"Everdur" is a registered trade-mark identifying products of The American Brass Company made from alloys of copper, silicon and other elements.

EVERDUR METAL *for* TANKS

RUSTLESS AS COPPER . . . STRONG AS STEEL

AIR COOLING AND CONDITIONING

Warning! Medicine Man sees hot winds ahead. A hot dusty summer in the offing. This is the forecast for 1935 of the Medicine Man of the Winnebago Tribe at the Wisconsin Dells. Are you prepared for such an eventuality? Will 1935 be a repetition of 1934?

WITTENMEIER, a name associated with Refrigeration in all its phases and applications for over 35 years, offers complete Air Conditioning and Refrigerating Systems for industrial purposes and bodily comfort, either in Central or Unit Systems from ¼-ton capacity up.

Refrigerants: CO_2—Freon—Ammonia—Methyl Chloride—Steam-Water Vapor.

When Architects, Engineers, Owners and Operators once realize that Air Cooling and Conditioning requires perfect coordinating of Heating, Ventilating and Refrigerating, then, and only then, will they appreciate the necessity of entrusting their Air Conditioning Problems with experienced contractors, not those who are experienced in only one or two of these fundamentals but contractors who are thoroughly familiar with all three.

Whether you are interested in conditioning a single room, office, shop, restaurant, bank, theatre, auditorium or large office building, there is a Wittenmeier System best suited for your needs.

Let us make a survey of your requirements and give you our unbiased opinion of the system best suited for your purpose. There is no obligation. Wittenmeier, with Air Cooling and Conditioning Experience that dates back to 1908, can offer helpful suggestions. Architects, Engineers, Contractors and others should avail themselves of this service. After all, there is no substitute for Experience.

WITTENMEIER MACHINERY COMPANY

Air Conditioning Engineers and Contractors

850-860 N. Spaulding Avenue, Chicago, Ill.

American Refrigerating Co.
Detroit, Michigan

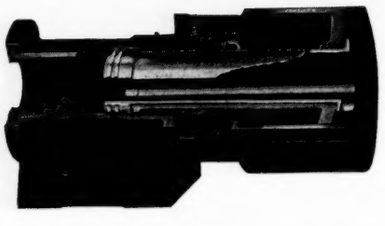
Wittenmeier Machinery Co. of N. Y.
103 Park Avenue, New York, N. Y.

H. J. Kelly
New Orleans, La.

Wittenmeier Machinery Co.
Columbus, Ohio

Wittenmeier continuously since 1897

ADSCO PISTON RING JOINT



Can Be Repacked Under Full Operating Pressure

Uninterrupted service is assured by the adaptation of the piston-ring principle to expansion joints. The stuffing box can be *unpacked* and *repacked* under full operating pressure. The country's leading engineers hail this as an outstanding achievement.

Ordinary maintenance on these long traverse Expansion Joints (4, 8 and 12 inches) may be conducted at any convenient time.

Write us today for the bulletin giving complete information regarding other important features of this outstanding joint.

AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA N.Y.
OVER FIFTY YEARS IN BUSINESS

District Heating Utilities Cut Cost

(Concluded from page 28)

The quantity of steam sold to large buildings has been reduced appreciably during the last two years due to a more general use of automatic control devices.

Rochester—A boiler plant development costing about $1 million is under construction at Station 3 of the Rochester Gas & Electric Corporation. This station supplies a large part of the steam used for the district distribution system and generates electricity as well.

Boston — Construction was relatively inactive, although there were several small extensions, including one to the new I. J. Fox Building and to the Bellevue Hotel, one of Boston's old landmarks. Steam sales are reported as currently satisfactory and as having shown a substantial increase during the past 12 months over the preceding 12-month period. The connected building cubage is increasing steadily. Fuel prices remained essentially the same with a slight downward trend.

Of interest is a new rate for residential service. This rate which begins at $1.40 per thousand pounds for the first 15,000 per month, drops to 95 cents for the next 20,000 lb. per month, and remains at 70 cents per thousand pounds thereafter. It represents a reduction of some 15 to 30% in the steam bills of residential customers, depending upon the load factor. The higher the load factor, the greater the reduction in the steam bill.

Other utility companies reported their efforts confined largely to routine operating and utilization work.

Mt. Holyoke Plant

Because of its unconventional features the plant at Mt. Holyoke College must be included in this summary. No operating data have appeared. The plant was described in detail in HEATING AND VENTILATING, November, 1934, page 22.

$160 Million for Heating and Ventilating Equipment

(Concluded from page 34)

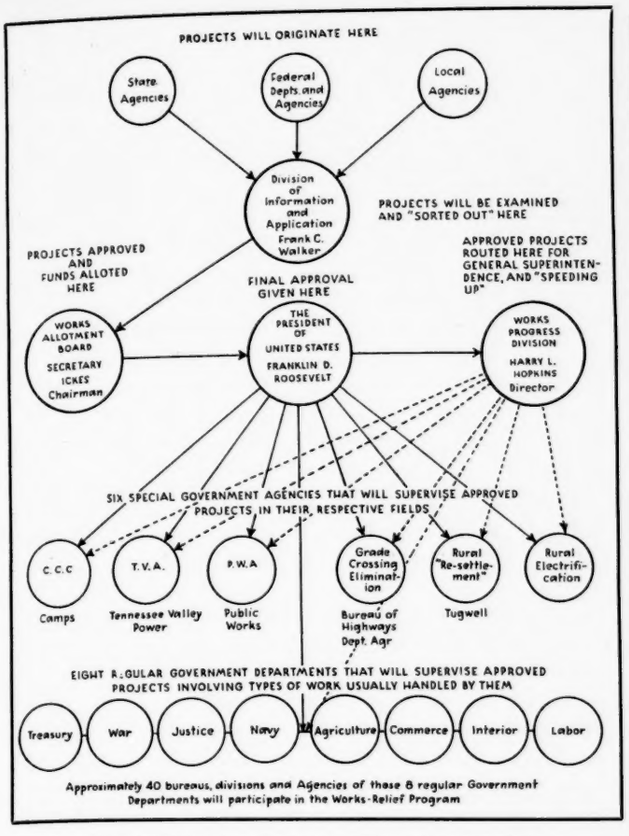
officers or to Washington by states, counties, municipalities, and other political divisions. These will be reviewed only by the Budget Bureau before going to the Allotment Board.

While specific projects have not yet commenced to take final form, business nevertheless is booming. The Urban Housing Division is in shape to go ahead rapidly. It has 39 approved projects on its lists, to cost $200 million, and 77 other projects under consideration. CCC is recruiting its membership up to 600,000 men, while the War Department has initiated plans for building at once 1276 new CCC camps at a cost of approximately $25 million.

Agencies Supervising Building Projects

While much of the $4 billion of work-relief funds will find its way into other channels, there is little

(Continued on next page)


PROJECTS WILL ORIGINATE HERE
State Agencies
Federal Depts. and Agencies
Local Agencies
Division of Information and Application Frank C. Walker
PROJECTS WILL BE EXAMINED AND "SORTED OUT" HERE
PROJECTS APPROVED AND FUNDS ALLOTED HERE
FINAL APPROVAL GIVEN HERE
APPROVED PROJECTS ROUTED HERE FOR GENERAL SUPERINTENDENCE, AND "SPEEDING UP"
WORKS ALLOTMENT BOARD SECRETARY ICKES Chairman
THE PRESIDENT OF UNITED STATES FRANKLIN D. ROOSEVELT
WORKS PROGRESS DIVISION HARRY L. HOPKINS Director
SIX SPECIAL GOVERNMENT AGENCIES THAT WILL SUPERVISE APPROVED PROJECTS IN THEIR RESPECTIVE FIELDS
C.C.C. Camps
T.V.A. Tennessee Valley Power
P.W.A. Public Works
Grade Crossing Elimination Bureau of Highways Dept. Agr
Rural "Re-settlement" Tugwell
Rural Electrification
EIGHT REGULAR GOVERNMENT DEPARTMENTS THAT WILL SUPERVISE APPROVED PROJECTS INVOLVING TYPES OF WORK USUALLY HANDLED BY THEM
Treasury
War
Justice
Navy
Agriculture
Commerce
Interior
Labor
Approximately 40 bureaus, divisions and Agencies of these 8 regular Government Departments will participate in the Works-Relief Program

How federal emergency relief will function.

doubt that a substantial portion of this huge sum will be expended for building construction projects. Under the President's plan of project operation, building construction enterprises will be directly supervised by government special and regular agencies, each agency superintending those projects that come within its particular field.

Following is a list of the most important of such government agencies, with a general indication of the types of building construction likely to be handled by each:

Rural Resettlement — This is a special government agency, newly established by the President. Among its duties will be the carrying on of the subsistence homestead work formerly under the Department of the Interior. The subsistence homestead work will, however, cease to exist after June 16. In addition farm families will be moved and new communities established. Such activities involve low-cost house building.

Federal Emergency Administration of Public Works (PWA)—Still under the direction of Secretary Ickes, this agency will have supervision of projects undertaken by states, municipalities, and other public bodies. Low-cost housing on a large scale will also be carried on by this unit.

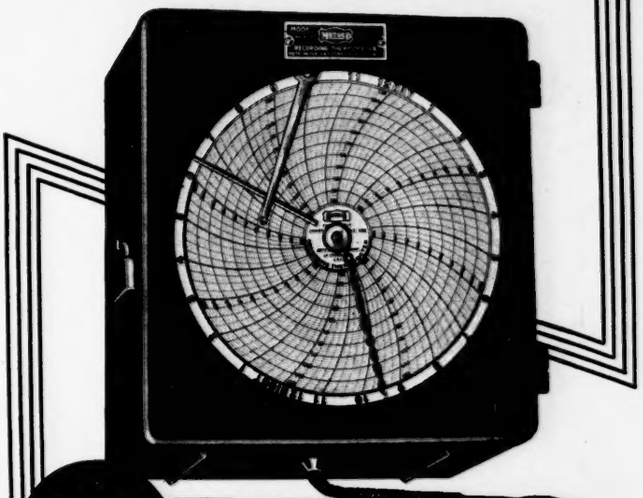
Coast Guard (Treasury Department)—Coast guard stations.

Procurement Division (Treasury) — Supervision of federal public buildings, including post offices.

Quartermaster General (War)—Supervision of projects relating to new buildings, reconstruction of buildings and other improvements in military reservations, posts, forts, etc.

(Continued on next page)

The MOTOCO RECORDING THERMOMETER
MODEL 500
SIX INCH CHART



$27.50 LIST PRICE
A MOTOMETER PRODUCT

THE Model "500" Motoco Recording Thermometer is a valuable addition to any equipment requiring temperature regulation. Its easy-reading, six-inch chart provides a continual, accurate temperature record and permits you to obtain greatest efficiency and economy in operation.

The Model "500" Motoco Recording Thermometer is the result of many years of manufacturing precision Temperature Indicating and Recording Instruments. The solid, liquid-filled movement is of exclusive Moto Meter design, sturdily constructed, and will render many years of valuable service.

The Model "500" is manufactured in three types; i.e., wall mounting with flexible capillary tubing, portable with strap handle and flexible capillary tubing, and portable self-contained.

Write for detailed information. We shall be pleased to quote on your requirements.

MOTOMETER GAUGE and EQUIPMENT CORPORATION
LA CROSSE, WISCONSIN U. S. A.

A GENUINE
MASTER
HEAT REGULATOR
only $13.50 to dealer

TYPE B-22
Two-Position
New Damper Regulator

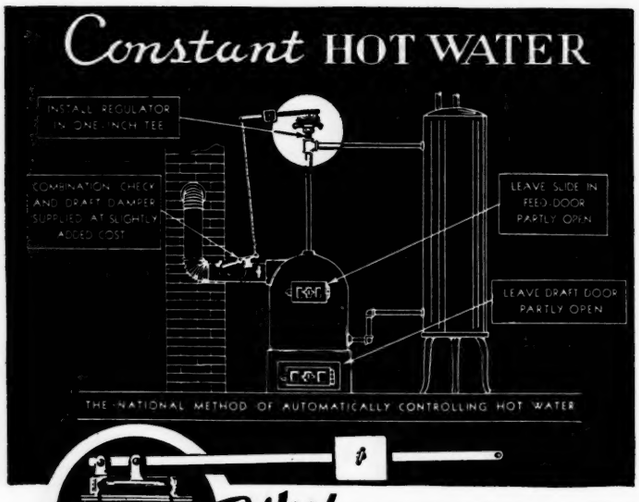
Easy to install. Accurate and quiet. Listed as standard by Underwriters Laboratories

Here is a regulator that you *know* is reliable enough for a mansion, yet priced within the reach of the modest home owner. Responsive to temperature changes of 1 degree. Ample power. Will outlast the heating plant. *Write for complete details.*

Made by
the Manufacturers of the famous Type B-144,
the Original Gradual Control Heat Regulator

WHITE MANUFACTURING CO.
2364 University Ave. ST. PAUL, MINN.

Constant HOT WATER


INSTALL REGULATOR IN ONE-INCH TEE
COMBINATION CHECK AND DRAFT DAMPER SUPPLIED AT SLIGHTLY ADDED COST
LEAVE SLIDE IN FEED DOOR PARTLY OPEN
LEAVE DRAFT DOOR PARTLY OPEN
THE NATIONAL METHOD OF AUTOMATICALLY CONTROLLING HOT WATER

With METAPHRAM
H-3 REGULATOR

Expressly Designed for Tank Heaters

Note this installation diagram. It is the short cut to satisfactory regulation of domestic hot water supply with *any* type of hand-fired tank heater. All connections are free from interference, and there can be no backing up of coal gas into the house or introduction of flattening air into the combustion chamber. The H-3 regulator is so low in price that any home owner can afford it. Yet it offers the sensitive and gradual control that you have always associated with Metaphram Regulators.

NATIONAL REGULATOR CO., 2309 KNOX AVE., CHICAGO

FULL STOCK CARRIED IN NEW YORK, 210 E. 45TH ST.

Department of Justice—Erection of federal prisons.

Bureau of Yards and Docks (Navy)—Supervision of projects for new buildings and other improvements in naval reservations, and work at yards and docks.

Bureau of Indian Affairs (Interior) — Erection of farm, school, recreation, and service buildings on Indian reservations.

National Park Service (Interior)—Erection of Park buildings in government parks, etc.

Office of Experiment Stations (Agriculture) — Experimental station buildings.

Bureau of Dairy Industry (Agriculture)—Dairy research laboratories.

Bureau of Plant Industry (Agriculture) — Experimental work buildings.

Bureau of Air Commerce (Commerce) — Airport projects.

Bureau of Lighthouses (Commerce)—Lighthouse establishments.

Veterans' Administration (Special Agency) — Veterans' hospitals.

Emergency Conservation Work (Special Agency)—Construction of CCC camps.

$2 Billion for Materials

Government and private experts estimate that at least half of the total work-relief fund of four billion dollars will go in payment of materials, equipment, and transportation. Tremendous quantities of steel, lumber, cement, clay products, electrical equipment, piping, and other materials will be needed for the various construction projects. The extent of the participation of respective industries in the program now getting under way is indicated roughly by figures obtained in the United States Census of the Construction Industry for 1929. On that basis, it is estimated that material expenditures will bulk somewhat as follows:

Concrete	$380,000,000
Steel	220,000,000
Lumber	200,000,000
Plumbing and gas	160,000,000
Heating and Ventilating	160,000,000
Electrical supplies	120,000,000
Brick	80,000,000
Roofing materials	72 000,000
Drain pipes	68,000,000
Paint and glass	42,000,000
Hardware	24,000,000
Plaster	20,000,000

These, of course, are only a few of the many kinds of materials for each of which millions will be expended.

How Materials will be Purchased

Purchase of materials by the government for projects approved under the Work-Relief program will be under the general supervision of Harry L. Hopkins, head of the newly-created Works Progress Division. However, direct charge of this important function has been given to Admiral Christian J. Peoples, head of the Procurement Division of the U. S. Treasury Department, who also will act as assistant to Hopkins.

It has been announced by the government that it proposes to purchase materials required by approved projects conducted under the supervision of Federal agencies in accordance with the Work-Relief program

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in large quantities and at the lowest possible prices, and to distribute such materials to the various projects as needed. While estimates have not yet been completed as to just what materials will be needed, nor have plans been made showing in what manner the distribution of materials will be made under this tremendous buying campaign, it is certain that purchases will be made in accordance with the usual government regulations.

Prospective sellers of materials likely to be used in types of projects to be initiated under the Work-Relief program should make contact with the Procurement Division of the U. S. Treasury, 9th and D Streets, S.W., Washington. The procedure covering government purchases of materials is as follows: When the needs of the government have been determined and it is ready to purchase, "Invitations for Bids" (standard form no. 30) are advertised or sent to an approved list of concerns supplying the types of materials wanted. This form indicates that sealed bids will be received at a designated place until the day and hour named in the notice. A detailed description of the materials wanted is attached. Bids must be submitted upon the standard government form of bid, standard form no. 31, and in accordance with the standard government instructions to bidders (standard form no. 22) and any special instructions supplementary thereto.

At the appointed time all bids are publicly opened and award made to the lowest responsible bidder, unless in the judgment of the government purchasing office, all bids are deemed unsatisfactory, in which event no award is made, and new bids are usually called for.

Concerns interested in selling materials to the government should take steps to keep in touch with advertised bid proposals, and to inquire if the names of their concerns may not be placed on the approved list of sellers to whom bid notices will be mailed. The particular types of materials handled should be indicated when request is made for places on mailing lists. Prospective sellers should also keep in mind that many of the projects conducted under the Work-Relief program will be let out under general or special contract, in which cases the purchasers of materials will not be government agencies, but rather the general or special contractors to whom awards are made. In most of such instances, however, specifications as to the materials to be used will be written or vised by government agencies. This suggests the necessity of determining in advance of sales efforts to contractors, whether the specifications controlling the project are such that the contractor can purchase the seller's materials, should he so desire. Inquiry at the Procurement Division of the U. S. Treasury will usually secure the specification information required.

NEW CATALOGS

***Automatic Switch Co.*, 154 Grand St., New York. A standard-size, 24-page catalog entitled "Solenoid Valves for Automatic and Remote Control." Includes complete information, drawings, and engineering data relating to the company's line of valves for air, gas, fuel oil, refrigerating water, and other fluids.**

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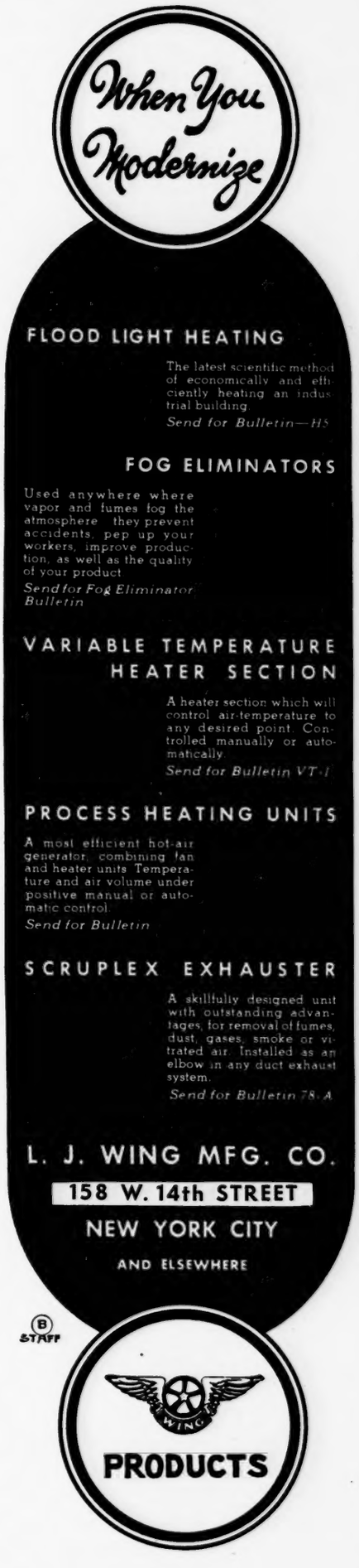
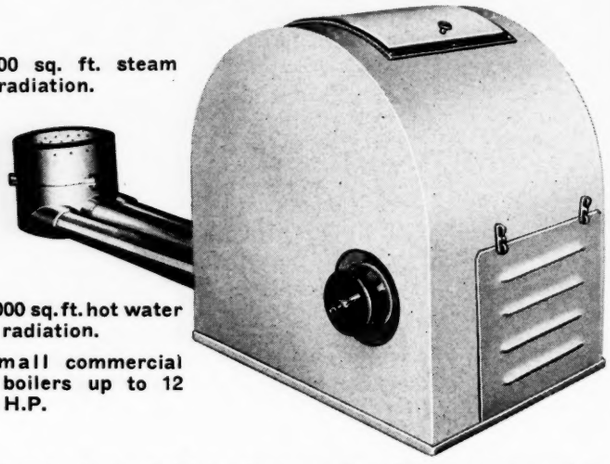

When You Modernize
FLOOD LIGHT HEATING
The latest scientific method of economically and efficiently heating an industrial building.
Send for Bulletin—H5
FOG ELIMINATORS
Used anywhere where vapor and fumes fog the atmosphere they prevent accidents, pep up your workers, improve production, as well as the quality of your product
Send for Fog Eliminator Bulletin
VARIABLE TEMPERATURE HEATER SECTION
A heater section which will control air-temperature to any desired point. Controlled manually or automatically.
Send for Bulletin VT-1
PROCESS HEATING UNITS
A most efficient hot-air generator, combining fan and heater units Temperature and air volume under positive manual or automatic control.
Send for Bulletin
SCRUPLEX EXHAUSTER
A skillfully designed unit with outstanding advantages, for removal of fumes, dust, gases, smoke or vitrated air. Installed as an elbow in any duct exhaust system.
Send for Bulletin 78-A
L. J. WING MFG. CO.
158 W. 14th STREET
NEW YORK CITY
AND ELSEWHERE
B STAFF
WING
PRODUCTS

Here is a Small Stoker that "can take it"

BUILT ESPECIALLY FOR DOMESTIC USE, BUT NOTE ITS CAPACITIES

1200 sq. ft. steam radiation.



2000 sq. ft. hot water radiation.

Small commercial boilers up to 12 H.P.

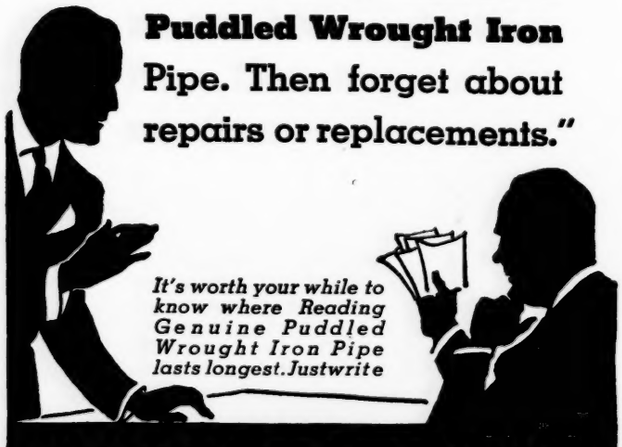
Ahead of the field in design. Sturdy in construction. Simple and economical to operate. Free from trouble and service.

Add this sturdy, high capacity machine to your line; it will solve your small stoker problem.

Write for details on our new dealer price arrangement.

STOKER EQUIPMENT CO.
SIDNEY, OHIO

"Sure, you can get by with cheap pipe here, for a while. But if you want to save some REAL money, better let me put in Reading Genuine Puddled Wrought Iron Pipe. Then forget about repairs or replacements."



READING IRON COMPANY
PHILADELPHIA

SCIENCE AND INVENTION HAVE NEVER FOUND A SATISFACTORY SUBSTITUTE FOR GENUINE PUDDLED WROUGHT IRON

American District Steam Co., North Tonawanda, N. Y., has published bulletin No. 35-75 illustrating and describing the Adsco storage water heater. Instructions on the selection of the proper size tank and heater are given together with data on the sizes, capacities, and dimensions of heater elements, storage tanks, and cradles for tanks. Standard size; 10 pages.

Armstrong Machine Works, Three Rivers, Mich. Catalog G, third edition of the Armstrong Steam Trap book. A 28-page, standard-size, profusely illustrated bulletin of practical information on operation, selection, installation of steam traps. The illustrations show not only applications of the traps but how they operate, and describe in considerable detail the difference between the company's various traps. A full-page graph is included for selecting the proper capacity of the trap, and included with this is a page of text for determining the size of the trap required; other pages for calculating the rate of condensation, special problems, and further information.

Bell & Gossett Co., 3000 Wallace St., Chicago. A standard-size, 20-page bulletin, punched for binder, entitled "Simplified Six Step Method of Designing Forced Circulation One and Two-Pipe Hot Water Heating Systems." Design methods outlined are based on the use of the company's booster pump, control valves, and other accessories. It includes simple methods of determining the quantity of water which must be circulated, selection of the booster, and layout and sizing of pipe, together with pipe sizing tables and installation data. Several pages are devoted to tables of heat loss coefficients and other data necessary for circulating radiation.

Binks Manufacturing Co., 3114-40 Carroll Ave., Chicago, has published an eight-page, two-color, Spray Nozzle Bulletin, known as No. 50. It contains complete spray nozzle data and selection charts for applications in the industrial field, air conditioning, water cooling and water washing work, brine spray refrigeration, spray drying, moistening, air humidifying, and hundreds of other industrial applications.

Carbondale Machine Corp., Harrison, N. J., has published a 12-page booklet for refrigeration engineers and operators of refrigeration equipment. This publication covers a line of horizontal single and duplex compressors, of single-stage and two-stage types, steam-driven and motor-driven. In addition to a detailed discussion of construction features, it contains dimension tables of various types of units. It is designated bulletin No. 1100.

Century Electric Co., 1806 Pine St., St. Louis. An 8-page, standard-size bulletin punched for insertion in binder, describing the company's polyphase motors from 1/6 to 600 hp. This line of motors was designed primarily for air conditioning, refrigeration, and similar applications. Profusely illustrated with brief descriptive material.

Diehl Manufacturing Co., Elizabethport, N. J., has published in standard size the 18-page "Diehl Simplified Price List and Catalog" covering the company's electric motors, generators, and ventilating equipment. It contains in simplified and condensed form a large amount of information useful to motor users, and in addition gives engineering data on the company's ventilating fans available in sizes from 9 to 16 in., and exhaust fans available in sizes from 18 to 48 in.

Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, has issued bulletin No. 4001 covering the application of electrical thermometers to air conditioning systems. The well-illustrated, 24-page booklet tells the owner, architect, engineer, and contractor what each needs to know about electrical thermometers.

Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. A booklet entitled "This Thing Called Air Conditioning," defining the functions of various types of air conditioning systems and the part played by automatic controls in air conditioning. Size 7⅛ x 10 in.; 32 pages; illustrated in color.

FOR CORROSIVE SERVICES SPECIFY

Wrought Iron ON ITS SERVICE RECORD

PROGRESS in building design and construction is often marked by the introduction of new materials. But new materials entail testing and proving, and leading architects and engineers seldom choose buildings such as those illustrated here as a "testing ground"—especially not for pipe.

That's why, in so many outstanding buildings, wrought iron pipe is being specified. Wrought iron has inherited, through generations of architects and engineers, an outstanding reputation for long-life, dependability and economy in corrosive service. Few materials used in building construction today offer such a background of authenticated service records.

Illustrated here are examples of how O'Meara & Hills have specified wrought iron on its service record. This engineering practice we call "Pipe Prescription."

Comparative service records, ASTM specifications, and other engineering data are available through any Byers Engineer or from our Engineering Service Department. A. M. Byers Company, Established 1864. Pittsburgh, Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston.

BYERS GENUINE WROUGHT IRON PRODUCTS

PIPE - WELDING FITTINGS - RIVETS - SPECIAL BENDING PIPE - O. D. TUBES
PLATES - SHEETS - CULVERTS - FORGING BILLETS - STRUCTURALS - BAR IRON